WOODLAND ESTATES
PRELIMINARY SOIL REPORT

KALIHI VALLEY, OAHU, HAWAII
TAX MAP KEY: 1-4-14: 1 & 26
1-4-16: 3

To:
PARK ENGINEERING, INC.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DECEMBER 6, 1973

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

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December 6, 1973

PARK ENGINEERING, INC.
1149 Bethel Street, Room 710
Honolulu, Hawaii 96813

Gentlemen:

Subject: Woodland Estates
Preliminary Soil Report
(for site grading for residential development)
Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

Transmitted herewith is our preliminary soil exploration report for site grading design purposes for residential development for the proposed Woodland Estates, Kalihi Valley, Oahu, Hawaii.

This report includes a Boring Location Sketch, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Ezra Koike
Ezra Koike

JWS/EK:rmf

C O N T E N T S

WOODLAND ESTATES
PRELIMINARY SOIL REPORT

KALIHI VALLEY, OAHU, HAWAII
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SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate general soil conditions for site grading design considerations for residential development for the proposed Woodland Estates, Kalihi Valley, Oahu, Hawaii.

This report includes field explorations, laboratory tests, general recommendations for site grading design considerations and limitations.

The foundation recommendations in this report do not apply to multi-family structures other than light single or duplex units.

FIELD EXPLORATION

Sixteen exploratory borings were made at the approximate locations shown on the Boring Location Sketch.

Also attached are boring logs and laboratory test results previously made for "Kalihi Subdivision - Horita", Soil Reconnaissance Report, July 18, 1972.

Borings were made with 3 and 4-in. diameter augers using finger type bits and drag bits. Soil samples were recovered with 2 and 3-in. diameter

thin-wall tubes and 2-in. standard split spoon samplers driven with a 140-lb hammer falling 30 inches.

LABORATORY TESTS

Laboratory tests included: natural water content and density, unconfined compression, laboratory vane shear, Atterberg limit, grain-size analysis, specific gravity, AASHO T-180-57 density, and CBR.

A summary of the laboratory test results is given in Tables IA thru IH.

SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GEOLOGIC AND SOIL CLASSIFICATIONS BY OTHERS

From a review of geologic literature and the U. S. Soil Conservation Service maps of the area, the soils may be generally described as older alluvium formed by the weathering of alluvial fans and talus deposits overlying lava flows.

Stearns, H. T. and U. S. Geologic Survey, "Geologic and Topographic Map of Island of Oahu," 1938:

Qa - Consolidated deposits, chiefly older alluvium

(Upper half of site)

Qhb - Honolulu volcanic series

basalt flows and pyroclastics

(Lower half of site)

U. S. Soil Conservation Service, "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," August 1972:

Lolekaa silty clay - (LoD) 15 to 20% slopes

(LoE) 25 to 40% slopes

(LoF) 40 to 70% slopes

Unified Soil Classification - MH, ML-MH

GENERAL SITE CONDITIONS

Site Location

The project site is located in upper Kalihi Valley near the end of Kalihi Street on the south side of the valley between Kalihi Street and Kalihi Stream and the Makiki Nursery site.

Annual Rainfall

The average annual rainfall varies from 100 to 150 inches.

Topography

The project site, in general, may be described as hillside terrain that slopes downward in a northerly direction towards Kalihi Stream at about 10 to 15% gradients with steeper slopes

of about 40 to 100% in localized areas, particularly next to natural drainageways. Portions of the central and lower areas of the site are relatively flat with gradients less than 5 to 10%.

Several intermittent drainageways cross the site sloping down towards Kalihi Stream. Five spring areas (Springs "A", "B", "C", "D" and "E") were noted along the lower portion of some of these drainageways. Probably the springs may be associated with the contact of the Honolulu volcanic series flow with the "older" alluvium. Some old water tunnels may be located in the vicinity of Spring "D" (see p. 396, H. T. Stearns and K. N. Vaksvik, "Geology and Groundwater Resources of the Island of Oahu, Hawaii," May 1935).

Some slumping of the ground surface was noted at the site (see Boring Location Sketch). The area is generally overgrown with grass, brush and trees.

Two old borrow source areas are located near the east and west boundaries of the site.

Several access roads cross the site and two houses are located in the northeast section of the site.

The elevation of the site varies from about 520 to 760 ft.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration and laboratory test results, the soils encountered in the borings may be generally approximated as follows:

Soft to stiff clayey silt (MH soils) with some decomposed rock and silty sand (SM) to about 20 to 30 ft, the depths drilled.

Some lava rock outcrops were noted in the lower portions of some of the drainageways near Kalihi Stream.

Water was noted in the borings along the lower half of the site at about 3 to 24-ft depths during the field explorations.

Variations to the above soil conditions are to be expected. For more detailed descriptions of soils encountered in the borings, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

In general, the present plan is to cut the ridges along the upper or southern side and along the lower one-third of the site and fill the east and central portions and gully areas. Cuts and fills up to about 20 to 45 ft are contemplated.

Construction of fills in the gully areas should be done with care.

Because the site is crossed by natural drainage paths with springs that will be filled over, surface and subsurface drainage systems will be an important part of the site grading design. Subdrains, chimney drains and gravel blankets should be provided, particularly in drainageways.

The spring areas should be located on the grading plan. Drainage and subdrainage systems should be designed for these areas to minimize any build-up of hydrostatic pressure in the fills due to seepage water.

Generous allowances for additional earthwork should be made for removal of soft soils in localized areas and the construction of fills with fairly well-graded granular material in low spots. Remedial work in slumping ground areas, especially near the existing nursery, will require the removal of the loose or soft soils to stiff ground and reconstruction with selected soils. A buttress fill with well-graded granular material may also be required for the cut slopes in this area.

Settlement gages should be installed and periodic level readings taken on fills over natural drainageways to monitor the progressive movements. Building construction in these areas should be delayed as long as practicable and preferably until settlement gages indicate negligible rates of settlement.

The lower (northern) sections of the site in cut areas may have some seepage problems and field adjustments may be required during construction.

In addition, unloading the toe of the existing slope may result in localized slope creep or slumps.

Site Grading

Drainage of the site is important for site development. In general, the on-site soils may be used for the construction of the general fills. The wetter soils may require drying which may delay construction. The construction of fills should be done as soon as practicable to allow the fill to settle before building construction.

The west portion of the site above the small waterfall area (around Spring "A") will be graded with fills of about 45 ft or more. The northeast corner (around Springs "D" and "E") and the central portion (around Springs "B" and "C") will generally be graded with fills of about 10 to 20 ft. Back-filling of the drainageways should be done with care. A positive pipe or path from the springs to below the proposed fills should be provided. Removal of soft surface soils, soft localized areas, placing of subdrains, and placing of select granular materials at the lower portion of fills should be considered. Lava rock appears to outcrop in localized sections at the gully bottom near the waterfall. The toe of the fill should be keyed into rocky ground whenever practicable.

Fills over the drainageways or gullies at the site should be designed with well placed subdrains. The toe or outer portion of fill slope should be constructed with granular material. In addition, chimney drains (vertical drains constructed with granular material) should be utilized across the larger fill areas downslope of proposed underground utility lines to lessen the possibility of water pressure build up.

In slump areas, the soft soils should be removed, subdrains installed and the slope should be reconstructed with fairly well-graded granular material. Flattening of the slopes should also be considered.

Grading work should be done in accordance with the requirements of the Revised Ordinances of Honolulu, 1969 As Amended; and as recommended below:

1. The area should be cleared and grubbed. Surface vegetation and miscellaneous debris should be cleared and removed prior to site filling.

2. Loose surface and stockpiled soils should be stripped to stiff natural ground before the placement of fills. Loose surface soils at finish grade should be scarified and recompacted.

3. Localized soft pockets encountered during the site preparation should be excavated and backfilled with compacted select material.

4. Thin sidehill fills (sliver fills) on sloping areas should be avoided.

5. Where fills are proposed on sidehill areas, gullies and natural drainageways, loose material at the bottom and sides should be stripped down to stiff natural ground before the placement of fills. New fills should be keyed into the stiff natural ground.

   Subdrains should be placed along the bottom of natural drainageways with laterals in a herringbone pattern along the sides of the drainageways.

6. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level

condition. As the fill is brought up, it should continually be keyed into stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

7. In general, the on-site soils may be used for the construction of general fills.

Where practicable, fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the AASHO T-180-57 test method. In roadway areas, the top 2 ft of fill should be compacted to 95% of the maximum density. To obtain this density, some imported material may be required if this compaction is not obtainable with on-site soils.

The on-site soils from the cut areas with relatively high water contents may be difficult to compact. When used for the construction of fills away from slopes, these soils may be compacted in one-foot layers to the maximum density obtainable in the laboratory at the water content approximating the field moisture condition. However, the dry density

of the compacted soil should be about 85% of AASHO Test No. T-180-57.

8. If boulders encountered during the grading work are proposed to be used in the construction of fills, they should be generally placed along the toe sections of fill slopes and outside of probable building sites.

   Before placing any boulders, the subgrade should be stripped to stiff natural ground and shaped to drain. A layer of filter material should be placed on the subgrade and the boulders placed on the filter layers. The void spaces between boulders should be filled with granular material. A blanket of filter material should be placed against the boulders before earth fills are placed against the boulders. See the attached sketch, Figure 1.

9. Provisions should be included to drain the site during and after filling operations.

Slopes

In general, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

Gravel blankets about 18 to 24 in. in thickness are recommended at the bottom of fill slopes. Buttress fills may be required should seepage water be encountered near the toes of cut slopes.

Fill slopes on the downstream side of natural drainageways should be constructed with granular material or flattened to 3 to 1 slopes.

For slope heights (top to toe) greater than 20 ft, 8-ft-wide benches should be placed at height intervals of about 15 ft.

To minimize erosion, the runoff from rainstorms should be diverted away from slopes by berms or ditches whenever practicable.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

Slope planting is recommended on cut and fill slopes to minimize erosion.

Slope adjustments or other precautions may be necessary if seepage zones, expansive clay pockets or soft spots are encountered in localized areas.

Foundations

In general, light, wood-frame residential structures are planned.

On fairly level sites, where the buildings are situated 15 to 20 ft from the top of slopes, slab-on-ground type construction may be considered.

On sloping sites and near the tops of slopes, post-and-beam type construction is recommended. Where the lot grades are flatter than 5 horizontal to 1 vertical, deep foot blocks may be considered (see Figure 2). Where the lot grades are steeper than 5 to 1, but less than 3 to 1, or where the building is located within 15 ft from the top of a slope or retaining wall, deep foundations are recommended.

Deep foundations for light wood-frame structures may be small diameter pipe piles. The piles should generally extend below an imaginary plane drawn upward from the toe of slope at about a 4 horizontal to 1 vertical slope. Minimum depths of about 6 ft should be considered and a maximum of about 20 ft may be considered for most situations. Concrete foot blocks should be tied in the up and down slope direction. See Figure 3. For 3-in. diameter pipe piles, allowable loads of about 6 kips per pile may be used.

In general, building foundations should not be considered on sloping hillsides where the slopes are steeper than 3 to 1.

Where light units are located near the top of retaining walls, the buildings should be set back of an imaginary plane drawn upward from the base of the wall at about a 1-1/2 horizontal to 1 vertical slope.

In general, the light residential structures should be designed to accommodate and resist some creep of the ground surface. Odd shaped and split level structures should be minimized or designed to tolerate surface creep of the ground. The use of masonry walls should be discouraged or used with care and designed to tolerate surface creep of the ground.

Expansion joints should be used to minimize the effects of differential settlements between building units.

Other general guidelines for foundation design are as follows:

1. For light, short-span residential structures, post-and-beam type foundations should generally be considered over sloping terrain at the site.

2. Slabs-on-ground construction over drainageways that will be filled should be discouraged or delayed as long as practicable to allow the subsoils to consolidate and adjust to the new fill loads. This will minimize future settlements.

3. Bearing values for a given soil usually vary with the size and depth of footings. For light residential structures, bearing values of about 1500 p.s.f. may be used for footings on stiff natural ground or on compacted fill.

4. Soft spots or pockets of loose material encountered in footing excavations or below the building area should be excavated and replaced with well-graded granular material.

5. Concrete slabs on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4-in. in size. The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade.

6. Construction of retaining walls on slopes should generally be avoided.

7. Good surface drainage away from the foundations of structures should be maintained and the site should be graded to prevent the ponding of water.

Retaining Walls

Retaining walls up to about 6 to 8 ft in height are planned in some locations.

Subdrains should be placed behind the walls below the footing level and should be daylighted at low points.

Fairly well-graded granular material or select granular material should be used for backfilling against the wall.

Bearing values of about 2000 p.s.f. may be used for retaining wall foundations resting on stiff natural ground or compacted select fill provided the wall is not on the side or top of slope.

For lateral earth pressures for walls unrestrained at the top, an equivalent fluid pressure of about 40 p.c.f. may be used for a level backfill. Where a sloping backfill or vehicular or other loads occur above the wall, adjustments should be made in the design. The center of pressure should be considered to act somewhat above the lower third of the triangular fluid pressure diagram, assuming that subdrainage and drainage of the backfill are provided.

Roadway

In general, for the light automobile traffic and drained subgrade conditions, an estimate of the roadway pavement thickness is as follows:

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. base course.
3. Subbase - 6-in. select borrow over a prepared subgrade.

Due to changing soil conditions and relatively high moisture soils at the site, provisions should be made in the contract documents to allow for local adjustments regarding select borrow subbase and borrow material requirements in the field in accordance with the design standards of the City and County of Honolulu.

In fill areas, the use of selected soils within the top 2 to 3 ft of the subgrade may reduce the thickness of or eliminate the need for the select borrow subbase or borrow courses.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at

low points, weep holes should be placed at subgrade levels thru the walls of the catch basins which are placed in these low areas.

Ground Water Seepage

Field adjustments should be expected where cut slopes extend below the natural ground water table. Gravel toe drains and subdrains may be installed depending upon the seepage conditions at the site.

Underground Utilities

Underground utilities should be placed after the fills are constructed.

The bottom of utility trenches should be daylighted and graded to shed water. The backfill and drainage of these utility trenches should be carefully designed.

Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Existing Cesspools

If cesspools are encountered within the proposed site, the locations of the cesspools should be verified.

Sludge should be removed from the bottom and the cesspool backfilled with well-graded granular material. The materials should be placed in thin layers and rammed into place or compacted with vibratory equipment. The top 5 ft of fill should be compacted in 6-in. compacted layers.

Any portion of building that rests over cesspools should be designed to span over the cesspool.

Unforeseen Conditions

Because of the variability of soil deposits, site improvements, designs and construction techniques, conditions may be encountered that cannot be foreseen with even the most exhaustive studies of site and project conditions. These unforeseen conditions should be recognized and then evaluated so that the designs or the construction methods may be modified accordingly, if necessary.

Unforeseen or undetected conditions such as soft spots, existing utility trenches, structure foundations, voids or cavities, old tunnels, boulders, expansive soil pockets or seepage water, etc., may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

Site Regrading

After mass grading work is done and cuts and fills are made according to the grading plans, regrading at some future date should be avoided unless done under the guidance of a soils engineer.

PROPOSED SPECIFICATION FOR EARTHWORK

WOODLAND ESTATES

General Description

This item shall consist of clearing and grubbing, preparing of land to be filled, excavating and filling of the land, spreading, compacting and testing of the fill, and subsidiary work for grading the site.

Clearing, Grubbing and Preparing Areas to be Filled

Vegetation, rubbish and miscellaneous material shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Topsoil, stockpiled soils and localized soft pockets shall be stripped to stiff natural ground before the placement of fills. Loose surface soils encountered at finish grade shall be scarified and recompacted.

Hard surfaces of existing haul roads shall be scarified down to stiff soils and recompacted to match the density of the surrounding soil.

The bottoms and sides of gullies or natural drainageways shall be stripped down to stiff natural ground before the placement of fills.

Subdrains and gravel blankets shall be placed along the bottoms of natural drainageways before the placement of fills.

Where fills are constructed on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill shall be benched to a generally level condition. As the fill is constructed in

approximately level layers, it shall continually be keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

Materials

Fill material shall consist of selected on-site soils or approved borrow soils. The soils shall contain no more than a trace of organic and deleterious matter.

Borrow soils shall be selected soils generally less than 6-in. maximum size, with more than 30% fines and a plasticity index generally less than 20.

Fill material placed in the top 2 ft of fills shall contain less than 30% gravel.

Select granular material for "gravel blanket" shall generally be well-graded, less than 1-1/2 in. maximum size and less than 15% fines passing the No. 200 sieve.

Select granular material for subdrains and chimney drains shall generally be less than 1-1/2 in. maximum size, with about 90% passing the 1-in. sieve. The material shall be well graded with about 5% fine passing the No. 200 sieve. The granular material shall be protected from mixing with the surrounding soil during construction and installation of the drains.

Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and blade-mixed during the spreading to attain uniformity of material and water content within each layer.

Rocks or cobbles shall not be allowed to nest and voids between rocks shall be filled and compacted with small stones or earth.

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content is near the optimum.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with AASHO Test No. T-180-57 or other comparable density tests. For fills in roadway areas, the top 2 ft of fill shall be compacted to 95% of the maximum density. Compaction shall be with sheepsfoot rollers, multiple-wheel pneumatic-tired rollers or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to obtain the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density readings shall be taken as often as necessary in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

The on-site soils from the cut areas with relatively high water contents may be difficult to compact. When used for construction of fills away from slopes, these soils may be compacted in one-foot lifts to the maximum density obtainable in the laboratory at the water content approximately the field moisture condition. However, the dry density of the compacted soil shall be greater than 85% of AASHO Test No. T-180-57.

Prior to considering using reduced compaction requirements for the construction of fills, the request shall be reviewed by the Engineer.

Boulder Fills

If boulders are used for the construction of fills, they shall be generally placed along the toe section of slopes. The subgrade shall be stripped to stiff natural ground, shaped to drain and a layer of

select material or low grade concrete shall be placed on it. Voids shall be filled with smaller granular soils. A blanket of filter material shall be placed against the boulder fill before construction of fills against it.

Excavation

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

Unforeseen Conditions

If unforeseen or undetected soil conditions such as soft spots, existing utility trenches, tunnels, structure foundations, voids or cavities, boulders, seepage water or expansive soil pockets, etc., are encountered, corrective measures shall be made in the field as they are detected.

Rainy Weather

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.

BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limit or sieve analysis test results.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES

LOCATION: Kalihi Valley, Oahu, Hawaii

Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 7 Sheet No. _____ of _____

Driller: W. LUM ASSOC., INC. Date: OCT. 19, 1973

Field Party: ASATO, KAU

Type of Boring: AUGER (VERSA DRILL) Diam.: 4"

Elev.: 630'± * Datum: —

Drill Bit: T.C. DRAG

Water Level	18.2'				
Time	3:00 PM				
Date	10-19-73				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 630'± *	0								
(MH)	MEDIUM, BROWN CLAYEY SILT			7-A	–	89	–	–	–	
				7-B	–	79	–	–	–	
		5		7-C	–	74	–	–	–	
(MH)	STIFF, BROWN CLAYEY SILT									
		10		7-D	–	77	–	–	–	
		15		7-E	–	83	–	–	–	
(MH)	MEDIUM TO STIFF MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK		WATER 10-19-73							
(MH)	MEDIUM TO STIFF MOTTLED TAN RED CLAYEY SILT	20		7-F	–	90	–	–	–	
	END OF BORING @ 21.5' 10-19-73									

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES
LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 8 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: OCT. 27 & 29, 1973
Field Party: MEYER, OSHIRO, ASATO, KAU
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 670'± * Datum: —
Drill Bit: T.C. DRAG

Water Level	NOT NOTICED	NOT NOTICED			
Time	—	12:00 NOON			
Date	10-27-73	10-29-73			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 670'± ↓ * 0										
(MH)	SOFT, LIGHT BROWN CLAYEY SILT W/ SOME ROOTS		2"SS	B-A	–	50	–	–	–		
MH	SOFT LIGHT BROWN CLAYEY SILT	5	2"S	B-B	112	61 LL= 91 PL= 55	69	–	500 620 660		2/0.5' 2/0.5' 2/0.5'
		10	2"SS	B-C	–	74	–	–	–		
MH	SOFT TO MEDIUM BROWN & RED CLAYEY SILT W/ TRACES OF GRAVEL	15	2"S	B-D	102	71 LL= 100 PL= 60	60	640	–		3/0.5' 3/0.5' 4/0.5'
(MH)	MEDIUM, BROWN-RED CLAYEY SILT	20	2"SS	B-E	–	65	–	–	–		
	END OF BORING @ 21.5' 10-29-73										

NOTE
LL: LIQUID LIMIT
PL: PLASTIC LIMIT

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

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Boring Log

PROJECT WOODLAND ESTATES

LOCATION Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER: Weight 140#, Drop 30"

SAMPLER: 2"SS - 2" STANDARD SPLIT SPOON
2"S - 2"O.D. THIN WALL TUBE

BORING NO. 9 Sheet No. ____ of ____

Driller W. LUM ASSOC., INC. Date OCT. 23, 26 & 27, 1973

Field Party ASATO, CHOW, MEYER, OSHIRO

Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"

Elev. 670'± * Datum —

Drill Bit FINGER TYPE

Water Level NOT NOTICED

Time —

Date 10-23-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2"O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 670'± *	0									
(MH)	SOFT, MOTTLED BROWN-RED CLAYEY SILT W/TRACES OF DECOMPOSED ROCK & ROOTS		2"SS	9-A	—	58	—	—	—	3/1.0'	
			2"SS	9-B	—	59	—	—	—		
(MH)	SOFT, BROWN CLAYEY SILT W/TRACES OF GRAVEL	5	2"SS	9-C	—	63 64	—	—	—	2/1.0'	
(MH)	SOFT, GRAY-BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	10							860 880 1080		
MH	MEDIUM, BROWN CLAYEY SILT		2"S	9-D	103	74 63 LL= 117 PL= 54	59	1220			3/0.5' 2/0.5' 4/0.5'
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT W/ DECOMPOSED ROCK	15	2"SS	9-E	—	65	—	—	—		
(MH)	STIFF, LIGHT BROWN, GRAY, BLACK & RED CLAYEY SILT W/ DECOMPOSED ROCK	20	2"SS	9-F	—	68	—	—	—		
	END OF BORING @ 21.5' 10-27-73										

NOTE
LL: LIQUID LIMIT
PL: PLASTIC LIMIT

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WOODLAND ESTATES

LOCATION Kalihi Valley, Oahu, Hawaii

Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2"SS - 2" O.D. THIN WALL TUBE
2"SS - 2" STANDARD SPLIT SPOON

BORING NO. 10 Sheet No. ____ of ____

Driller W. LUM ASSOC., INC. Date OCT. 31 & NOV. 2, 1973

Field Party ASATO, OSHIRO, KAU

Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"

Elev. 557'± * Datum —

Drill Bit T.C. DRAG

Water Level	NOT NOTICED	5.0'			
Time	3:00 PM	1:00 PM			
Date	10-31-73	11-2-73			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 557'± *	0									
(MH)	MEDIUM, BROWN CLAYEY SILT W/TRACES OF ROOTS		2"SS	10-A	—	83	—	—	—		
(MH)	MEDIUM, GRAY BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK		2"SS	10-B	—	81	—	—	—	2/0.5' 5/0.5'	
		5	WATER 11-2-73								
(MH)	SOFT, GRAY BROWN CLAYEY SILT W/ DECOMPOSED ROCK		2"SS	10-C	—	101	—	—	—	3/1.0'	
		10									
(GM)	GRAY BROWN DECOMPOSED ROCK W/CLAYEY SILT		2"S	10-D	92	120	42	370	—		2/0.5' 1/0.5' 2/0.5'
	COBBLE OR BOULDER	15	2"SS	10-E	ROCK FRAGMENTS						50/0.1'
	END OF BORING @ 15' 11-2-73										HAMMER BOUNCES

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WOODLAND ESTATES

LOCATION Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 11 Sheet No. _____ of _____
Driller W. LUM ASSOC., INC. Date OCT. 15, 1973
Field Party ASATO, KAU, OSHIRO
Type of Boring AUGER (VERSA DRILL) Diam. 4"
Elev. 595'± * Datum —
Drill Bit T.C. DRAG

Water Level				
NOT NOTICED				
Time 3:00 PM				
Date 10-15-73				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 595'± *	0								
(MH)	SOFT TO MEDIUM TAN BROWN CLAYEY SILT			11-A	–	87	–	–	–	
				11-B	–	91	–	–	–	
MH	MEDIUM, TAN BROWN CLAYEY SILT	5		11-C	–	84 LL= 93 PL= 69	–	–	–	
(MH)	MEDIUM, MOTTLED GRAY-BROWN & RED CLAYEY SILT (DECOMPOSED ROCK)	10		11-D	–	89	–	–	–	
		15		11-E	–	93	–	–	–	
(MH)	MEDIUM MOTTLED GRAY BROWN CLAYEY SILT W/ DECOMPOSED ROCK									
		20		11-F	–	96	–	–	–	
	END OF BORING @ 21.5' 10-15-73									

NOTE
LL= LIQUID LIMIT
PL= PLASTIC LIMIT

*ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES

LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2"SS - 2" O.D. THIN WALL TUBE
2"SS - 2" STANDARD SPLIT SPOON

BORING NO. 12 Sheet No. _____ of _____
Driller: W. LUM ASSOC., INC. Date: OCT. 30, 1973
Field Party: ASATO, OSHIRO, KAU
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 595'± * Datum: —
Drill Bit: T.C. DRAG

Water Level	6.5'				
Time	1:00 PM				
Date	10-30-73				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test (N Blows per foot) / 2" O.D. THIN WALL TUBE SAMPLER (BLOWS/0.5')
	ELEV. = 595'± *	0								0 10 20 30 40
(MH)	STIFF, BROWN CLAYEY SILT W/ GRAY DECOMPOSED ROCK		2"SS	12-A	–	59	–	–	–	
			2"SS	12-B	–	41	–	–	–	4/0.5' 21/0.5'
	COBBLE OR BOULDER	5								
(MH)	STIFF, MOTTLED GRAY BROWN CLAYEY SILT & DECOMPOSED ROCK	WATER 10-30-73	2"SS	12-C	–	48	–	–	–	
		10	2"SS	12-D	–	77	–	–	–	2/0.5' 5/0.5'
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK									
		15	2"S	12-E	–	94 83	–	850	–	3/0.5' 2/0.5' 3/0.5'
(MH)	TAN, CLAYEY SILT W/SOME DECOMPOSED ROCK	20								
			2"SS	12-F	–	92	–	–	–	
	END OF BORING @ 21.5' 10-30-73									

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES

LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 13 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: OCT. 17, 1973
Field Party: ASATO, OSHIRO
Type of Boring: AUGER (VERSA DRILL) Diam.: 4"
Elev.: 602'±* Datum: —
Drill Bit: T.C. DRAG

Water Level	14.7'	9.3'	8.5'		
Time	3:00 PM	8:30 AM	8:30 AM		
Date	10-17-73	10-19-73	10-20-73		

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.
	ELEV. = 602'±*	0							
MH	STIFF, MOTTLED BROWN CLAYEY SILT W/GRAVEL			13-A	—	58	—	—	—
				13-B	—	40	—	—	—
						LL = 80			
	GRAY, DECOMPOSED ROCK FRAGMENTS W/ TRACES OF CLAYEY SILT	5				PL = 50			
				13-C	—	13	—	—	—
			WATER 10-20-73						
(MH)	MEDIUM TO STIFF GRAY BROWN CLAYEY SILT W/TRACES OF GRAVEL	10		13-D	—	34	—	—	—
		15		13-E	—	56	—	—	—
(MH)	STIFF MOTTLED GRAY BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK								
		20		13-F	—	69	—	—	—
	END OF BORING @ 21.5' 10-17-73								

PENETRATION DATA
Standard Penetration Test
N (Blows per foot) 0 10 20 30 40

NOTE
LL: LIQUID LIMIT
PL: PLASTIC LIMIT

*ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES.

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WOODLAND ESTATES

LOCATION Kalihi Valley, Oahu, Hawaii

Tax Map Key: 1-4-14: 1 & 26

1-4-16: 3

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 14 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date OCT. 15, 1973

Field Party ASATO, KAU, OSHIRO

Type of Boring AUGER (VERSA DRILL) Diam. 4"

Elev. 560'± * Datum —

Drill Bit T.C. DRAG

Water Level	9.4'	4.0'			
Time	1:00 PM	8:00 AM			
Date	10-15-73	10-16-73			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 560'± *	0								
MH	STIFF MOTTLED GRAY BROWN CLAYEY SILT		WATER 10-16-73 ▽	14-A	–	67	–	–	–	
		5		14-B	–	96	–	–	–	
						LL = 106				
						PL = 61				
				14-C	–	112	–	–	–	
(MH)	STIFF, GRAY BROWN CLAYEY SILT W/ DECOMPOSED ROCK	10								
	ROCK OR BOULDER			14-D	–	57	–	–	–	50/0.4'
	NOTE: DRILL TIME 10'-12' 20 MIN. MOVED HOLE 7' AWAY. DRILL TIME 8.5'-14.0' 25 MIN.									
	END OF BORING @ 14' 10-15-73									

NOTE

LL: LIQUID LIMIT

PL: PLASTIC LIMIT

*ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WOODLAND ESTATES

LOCATION Kalihi Valley, Oahu, Hawaii

Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight 140#
Drop 30"

SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 15 Sheet No. ____ of ____

Driller W. LUM ASSOC., INC. Date OCT. 20, 1973

Field Party MEYER, ASATO, KAU

Type of Boring AUGER (VERSA DRILL) Diam. 4"

Elev. 557'± * Datum —

Drill Bit T.C. DRAG

Water Level	5.6'				
Time	11:30AM				
Date	10-20-73				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test / 2" O.D. THIN WALL TUBE SAMPLER — N (Blows per foot) 0 10 20 30 40 — BLOWS/0.5'
	ELEV. = 557'± * 70									
(MH)	MEDIUM, TAN BROWN CLAYEY SILT W/TRACES OF GRAY, DECOMPOSED ROCK		2"SS	15-A	-	61	-	-	-	
(MH)	MEDIUM, TAN BROWN CLAYEY SILT		2"SS	15-B	-	64	-	-	-	
	WATER 10-20-73	5								
	TAN BROWN DECOMPOSED ROCK W/CLAYEY SILT		2"S	15-C	116	62	72	1110	-	4/0.5' 4/0.5' 5/0.5'
		10								
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/SOME DECOMPOSED ROCK		2"SS	15-D	-	54	-	-	-	
		15								
(MH)	SOFT, MOTTLED BROWN CLAYEY SILT		2"SS	15-E	-	74	-	-	-	
	MEDIUM STIFF	20								
(MH)	MOTTLED GRAY-BROWN CLAYEY SILT		2"SS	15-F	-	76	-	-	-	
	END OF BORING @ 21.5' 10-20-73									

*ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES
LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" SS - 2" STANDARD SPLIT SPOON
3" S - 3" O.D. THIN WALL TUBE

BORING NO. 16 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: OCT. 17, 1973
Field Party: ASATO, OSHIRO
Type of Boring: AUGER (VERSA DRILL) Diam.: 4"
Elev.: 574'± * Datum: —
Drill Bit: T.C. DRAG

Water Level	9.0'	3.9'	
Time	11:00 AM	9:00 AM	
Date	10-17-73	10-20-73	

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 3" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 574'± * 70										
(MH)	MEDIUM, BROWN CLAYEY SILT W/SOME DECOMPOSED ROCK		2"SS	16-A	—	65	—	—	—		
MH	STIFF, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	WATER 10-20-73 ▽	2"SS	16-B	—	77 LL= 79 PL= 61	—	—	—		
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT	5	2"SS	16-C	—	94	—	—	—		
	MOTTLED BROWN DECOMPOSED ROCK (SOME CRUSHES TO CLAYEY SILT)	10	3"S	16-D	104	68	62	960	—		4/0.5' 8/0.5' 9/0.5'
(MH)	SOFT, MOTTLED BROWN CLAYEY SILT W/SAND & DECOMPOSED ROCK	15	2"SS	16-E	—	75	—	—	—		
MH	STIFF, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	20	2"SS	16-F	—	56 LL= 63 PL= 52	—	—	—		
	END OF BORING @ 21.5' 10-17-73										

NOTE
LL= LIQUID LIMIT
PL= PLASTIC LIMIT

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES

LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" STANDARD

BORING NO. 17 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: OCT. 16, 1973
Field Party: ASATO, OSHIRO
Type of Boring: AUGER (VERSA DRILL) Diam.: 4"
Elev.: 565'± * Datum: —
Drill Bit: T.C. DRAG

Water Level	NOT NOTICED	17.3'			
Time	—	9:00 AM			
Date	10-16-73	10-20-73			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 565'± *	0								
(MH)	SOFT, BROWN CLAYEY SILT			17-A	—	60	—	—	—	
MH	STIFF, BROWN-RED CLAYEY SILT			17-B	—	71	—	—	—	
						LL = 106				
						PL = 73				
		5								
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT			17-C	—	65	—	—	—	
MH	STIFF TO MEDIUM MOTTLED GRAY BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	10		17-D	—	49	—	—	—	
						LL = 71				
						PL = 48				
MH	MEDIUM, MOTTLED LIGHT BROWN CLAYEY SILT	15	WATER 10-20-73	17-E	—	56	—	—	—	
						LL = 63				
						PL = 51				
(MH)	STIFF MOTTLED GRAY BROWN CLAYEY SILT W/ DECOMPOSED ROCK	20		17-F	—	56	—	—	—	47
	END OF BORING @ 21.5' 10-16-73									

NOTE
LL= LIQUID LIMIT
PL= PLASTIC LIMIT

*ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT WOODLAND ESTATES

LOCATION Kalihi Valley, Oahu, Hawaii

Tax Map Key: 1-4-14: 1 & 26

1-4-16: 3

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 18 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date NOV. 3, 1973

Field Party ASATO, OSHIRO

Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"

Elev. 550'± * Datum —

Drill Bit T.C. DRAG

Water Level	7.5'				
Time	1:00 PM				
Date	11-3-73				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV.≈ 550'±*	0								
(MH)	STIFF, MOTTLED GRAY BROWN SANDY SILT W/TRACES OF DECOMPOSED ROCK			18-A	—	51	—	—	—	
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/SOME DECOMPOSED ROCK			18-B	—	47	—	—	—	
		5								
	GRAY DECOMPOSED ROCK		WATER 11-3-73	18-C	—	49	—	—	—	50/0.4'
(MH)	STIFF MOTTLED GRAY BROWN SANDY SILT W/ DECOMPOSED ROCK	10		18-D	—	47	—	—	—	19/0.5' 40/0.3'
	COBBLE OR BOULDER									
	GRAY BROWN DECOMPOSED ROCK W/SANDY SILT	15		18-E	—	45	—	—	—	50/0.3'
	END OF BORING @ 14.3' 11-3-73									

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES

LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 20 Sheet No. _____ of _____

Driller: W. LUM ASSOC., INC. Date: AUG. 13, 1973

Field Party: MEYER, OSHIRO

Type of Boring: AUGER (VERSA DRILL) Diam.: 4"

Elev.: 592'± * Datum: —

Drill Bit: T.C. DRAG

Water Level	6.2'	6.1'	6.4'	6.1'
Time	10:25 AM	2:50 PM	-	1:30 PM
Date	8-13-73	8-14-73	8-17-73	8-23-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5
	ELEV. = 592'±*										
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT		2"SS	20-A	-	68	-	-	-		
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK		2"SS	20-B	-	74	-	-	-		
MH	MEDIUM, LIGHT BROWN CLAYEY SILT	5	2"S	20-C	100	85 71	54	2120	480 700		3/0.5' 4/0.5' 3/0.5'
	WATER 8-13-73					LL= 92 PL= 64					
MH	MEDIUM, LIGHT BROWN, RED, TAN & BLACK CLAYEY SILT	10	2"SS	20-D	-	94	-	-	-		
						LL= 83 PL= 63					
		15	2"S	20-E	106	74	61	740	-		3/0.5' 4/0.5'
(MH)	MEDIUM MOTTLED BROWN & BLACK CLAYEY SILT W/SOME DECOMPOSED ROCK										
		20	2"SS	20-F	-	71	-	-	-	3/0.5' 8/0.5'	
	END OF BORING @ 21.5' 8-13-73										

NOTE
LL= LIQUID LIMIT
PL= PLASTIC LIMIT

* ELEV. ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES
LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2"SS - 2"O.D. THIN WALL TUBE
2"SS - 2" STANDARD SPLIT SPOON

BORING NO. 23 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: AUG. 10, 1973
Field Party: METER, OSHIRO
Type of Boring: AUGER (VERSA DRILL) Diam.: 4"
Elev.: 569'±* Datum: —
Drill Bit: T.C. DRAG

Water Level	8.0'	6.9'	7.4'	8.0'
Time	3:20 PM	8:45 AM	—	1:40 PM
Date	8-10-73	8-13-73	8-17-73	8-23-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 569'±* COBBLES & GRASS	0									
(MH)	STIFF MOTTLED BROWN CLAYEY SILT W/ROOTS		2"SS	23-A	—	49	—	—	—		
			2"SS	23-B	—	56	—	—	—		
		5				102					
MH	SOFT, MOTTLED RED CLAYEY SILT		2"SS WATER 8-23-73	23-C	—	86 LL= 77 PL= 71	—	—	—		
		10									
			2"S	23-D	119	85	64	—	—		3/0.5' 3/0.5' 3/0.5'
MH	SOFT TO MEDIUM MOTTLED BROWN & BLACK CLAYEY SILT W/SOME DECOMPOSED ROCK										
		15									
			2"SS	23-E	—	63 LL= 57 PL= 51	—	—	—		
MH	MEDIUM, BROWN & BLACK CLAYEY SILT	20									
			2"SS	23-F	—	69 LL= 61 PL= 47	—	—	—		
	END OF BORING @ 21.5' 8-10-73										

NOTE
LL= LIQUID LIMIT
PL= PLASTIC LIMIT

*ELEV. ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATE

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES

LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"

SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 24 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date AUG. 13, 1973
Field Party MEYER, OSHIRO
Type of Boring AUGER (VERSA DRILL) Diam. 4"
Elev. 600'± * Datum —
Drill Bit T.C. DRAG

Water Level	22'	23.1'	23.2'	23.4'
Time	1:30 PM	2:45 PM	-	2:00 PM
Date	8-13-73	8-14-73	8-17-73	8-23-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 600'± *)	0									
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT		2"SS	24-A	—	52	—	—	—		
(MH)	SOFT, BROWN CLAYEY SILT W/TRACES OF GRAVEL & ORGANIC MATTER (GRASS)		2"SS	24-B	—	62	—	—	—	2/1.0'	
		5	2"S	24-C	—	85	—	2600	—		4/0.5' 5/0.5'
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT										
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT	10	2"SS	24-D	—	71	—	—	—		
MH	MEDIUM, LIGHT BROWN CLAYEY SILT W/SOME DECOMPOSED ROCK	15	2"S	24-E	109	68	65 LL= 83 PL= 53	2020	—		2/0.5' 2/0.5'
(MH)	MEDIUM, LIGHT BROWN RED & BLACK CLAYEY SILT	20	2"SS	24-F	—	79	—	—	—		
			WATER 8-23-73								
(MH)	STIFF, LIGHT BROWN & GRAY CLAYEY SILT	25	2"S	24-G	108	60	67	2120	—		4/0.5' 5/0.5'
(MH)	MEDIUM, BROWN & BLACK CLAYEY SILT										
MH	MEDIUM TO SOFT BROWN & BLACK CLAYEY SILT	30	2"SS	24-H	—	77 78	— LL= 65 PL= 50	—	—		
	END OF BORING @ 31.5' 8-13-73										

* ELEV. ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

WOODLAND ESTATES

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: WOODLAND ESTATES
LOCATION: Kalihi Valley, Oahu, Hawaii
Tax Map Key: 1-4-14: 1 & 26
1-4-16: 3

HAMMER: Weight 140#, Drop 30"
SAMPLER: 2"SS - 2" O.D. THIN WALL TUBE; 2"SS - 2" STANDARD SPLIT SPOON

BORING NO. 27 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date AUG. 10, 1973
Field Party MEYER, OSHIRO
Type of Boring AUGER (VERSA DRILL) Diam. 4"
Elev. 553'± * Datum ____
Drill Bit T.C. DRAG

Water Level	3.1'	2.6	2.8'	3.4'
Time	2:15 PM	2:35PM	-	1:50PM
Date	8-10-73	8-14-73	8-17-73	8-23-73

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Uncont. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV.= 553'± *	0									
	COBBLES W/ DARK BROWN ORGANIC CLAYS & PLANTS										
(MH)	SOFT, BROWN CLAYEY SILT		2"SS	27-A	-	71	-	-	-	3/1.0'	
	WATER 8-23-73										
MH	SOFT, LIGHT MOTTLED BROWN CLAYEY SILT	5	2"S	27-B	106	81 LL= 66 PL= 50	59	690	220 260 380		1/0.5' 1/0.5' 1/0.5'
(MH)	MEDIUM TO STIFF BROWN, GRAY & BLACK CLAYEY SILT (DEC. ROCK)	10	2"S	27-C	-	65 51	-	2550	-		2/0.5' 7/0.5'
MH	MEDIUM, GRAY, BROWN & BLACK CLAYEY SILT (DEC. ROCK)	15	2"SS	27-D	-	65 LL= 61 PL= 50	-	-	-		
	ROCK OR BOULDER	20	2"SS	27-E	-	56	-	-	-		40/0.1'
	END OF BORING @ 20.6' 8-10-73										HAMMER BOUNCES
	NOTE: AT 20.6' DRILLED FOR 10 MIN. NO ADVANCE MT.										
	* ELEV. ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.										

WOODLAND ESTATES

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	4	6	8	8
SAMPLE NO.				B
DEPTH BELOW SURFACE	SURFACE	SURFACE	SURFACE	5'-6.5'
DESCRIPTION	BROWN CLAYEY SILT W/DECOMP. ROCK	BROWN CLAYEY SILT	BROWN CLAYEY SILT W/DECOMP. ROCK	LIGHT BROWN CLAYEY SILT
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	72	87	103	91
Plastic Limit	50	58	59	55
Plasticity Index	22	29	44	36
Dilatancy	SLOW	MEDIUM	MED.-SLOW	MEDIUM
Toughness	MEDIUM	SLIGHT-MED	MEDIUM	SLIGHT-MED.
Dry Strength	SLIGHT-MED	SLIGHT-MED	SLIGHT-MED.	SLIGHT-MED.
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	MH
APPARENT SPECIFIC GRAVITY	2.89	2.97	2.92	
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	38.4	44.0	46.7	
Molding Dry Density, P.C.F.	81.9	79.1	75.7	
Swell upon saturation, %	0.3	0.5	0.3	
CBR at 0.1" Penetration	17.3	21.0	20.7	
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHO T-180-57 Method ___)	A	A	A	
Dry to Wet or Wet to Dry	WET TO DRY	WET TO DRY	WET TO DRY	
Max. Dry Density (P.C.F.)	85.5	78.0	83.1	
Optimum Moisture (%)	34.5	38.8	36.6	

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By BT.

WOODLAND ESTATES

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	8	9	11	
SAMPLE NO.	D	D (BTM.)	C	
DEPTH BELOW SURFACE	15'-16.5'	10'-11.5'	5'-6.5'	
DESCRIPTION	BROWN & RED CLAYEY SILT W/TRACES OF GRAVEL	BROWN CLAYEY SILT	TAN-BROWN CLAYEY SILT	
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	100	117	93	
Plastic Limit	60	54	69	
Plasticity Index	40	63	24	
Dilatancy	MEDIUM	SLOW	MEDIUM	
Toughness	SLIGHT-MED.	SLIGHT-MED.	SLIGHT-MED.	
Dry Strength	SLIGHT-MED.	SLIGHT-MED.	SLIGHT-MED.	
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	
APPARENT SPECIFIC GRAVITY				
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By BT.

WOODLAND ESTATES

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	13	13	14	14
SAMPLE NO.		B		B
DEPTH BELOW SURFACE	SURFACE	2.5'-4'	SURFACE	2.5'-4.5'
DESCRIPTION	BROWN CLAYEY SILT	MOTTLED BROWN CLAYEY SILT W/GRAVEL	MOTTLED BROWN CLAYEY SILT W/DECOMP. ROCK	MOTTLED GRAY-BROWN CLAYEY SILT
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	92	80	90	106
Plastic Limit	58	50	59	61
Plasticity Index	34	30	31	45
Dilatancy	MEDIUM	MEDIUM	MEDIUM	MED.-SLOW
Toughness	SLIGHT-MED.	SLIGHT-MED.	MED.-SLIGHT	MED.-HIGH
Dry Strength	SLIGHT-MED	SLIGHT-MED.	SLIGHT-MED	SLIGHT-MED.
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	MH
APPARENT SPECIFIC GRAVITY	3.05		2.97	
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	51.1		41.8	
Molding Dry Density, P.C.F.	69.4		78.9	
Swell upon saturation, %	0.1		0.7	
CBR at 0.1" Penetration	3.7		26.7	
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHO T-180-57 Method ___)	A		A	
Dry to Wet or Wet to Dry	WET TO DRY		WET TO DRY	
Max. Dry Density (P.C.F.)	81.6		79.5	
Optimum Moisture (%)	37.0		36.6	

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By BT

WOODLAND ESTATES

TABLE I D - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	16	16		17
SAMPLE NO.	B	F		
DEPTH BELOW SURFACE	2.5'-4'	20'-21.5'		SURFACE
DESCRIPTION	MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK	MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK		BROWN CLAYEY SILT
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	79	63		95
Plastic Limit	61	52		69
Plasticity Index	18	11		26
Dilatancy	MED.-QUICK	MEDIUM		MEDIUM
Toughness	SLIGHT-MED.	SLIGHT		SLIGHT
Dry Strength	SLIGHT-MED.	SLIGHT		SLIGHT-MED.
UNIFIED SOIL CLASSIFICATION	MH	MH		MH
APPARENT SPECIFIC GRAVITY				2.92
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				50.8
Molding Dry Density, P.C.F.				71.1
Swell upon saturation, %				0.3
CBR at 0.1" Penetration				9.6
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				A
Dry to Wet or Wet to Dry				WET TO DRY
Max. Dry Density (P.C.F.)				73.0
Optimum Moisture (%)				46.6

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By DJT

WOODLAND ESTATES

TABLE IE - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	17	17	17	
SAMPLE NO.	B	D	E	
DEPTH BELOW SURFACE	2.5'-4'	10'-11.5'	15'-16.5'	
DESCRIPTION	BROWN-RED CLAYEY SILT	MOTTLED GRAY-BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK	MOTTLED LIGHT BROWN CLAYEY SILT	
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	106	71	63	
Plastic Limit	73	48	51	
Plasticity Index	33	23	12	
Dilatancy	MEDIUM	MEDIUM	QUICK	
Toughness	SLIGHT-MED.	SLIGHT-MED.	SLIGHT	
Dry Strength	SLIGHT-MED.	SLIGHT-MED.	SLIGHT	
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	
APPARENT SPECIFIC GRAVITY				
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By BT.

WOODLAND ESTATES

TABLE I F - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	20	20		23
SAMPLE NO.	C (BTM.)	D		C (BTM)
DEPTH BELOW SURFACE	5'-6.5'	10'-11.5'		5'-6.5'
DESCRIPTION	LIGHT BROWN CLAYEY SILT	LIGHT BROWN, RED, TAN & BLACK CLAYEY SILT		MOTTLED RED CLAYEY SILT
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	92	83		77
Plastic Limit	64	63		71
Plasticity Index	28	20		6
Dilatancy	MEDIUM	QUICK		QUICK
Toughness	SLIGHT	SLIGHT		SLIGHT
Dry Strength	SLIGHT-MED.	SLIGHT-MED.		SLIGHT
UNIFIED SOIL CLASSIFICATION	MH	MH		MH
APPARENT SPECIFIC GRAVITY				
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By BT

WOODLAND ESTATES

TABLE IG - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	23	23		24
SAMPLE NO.	E	F		
DEPTH BELOW SURFACE	15'-16.5'	20'-21'		SURFACE
DESCRIPTION	MOTTLED BROWN & BLACK CLAYEY SILT W/SOME DECOMP ROCK	BROWN & BLACK CLAYEY SILT		BROWN CLAYEY SILT W/ROOTS
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	57	61		84
Plastic Limit	51	47		54
Plasticity Index	6	14		30
Dilatancy	QUICK	QUICK		MEDIUM
Toughness	SLIGHT	SLIGHT		MEDIUM
Dry Strength	SLIGHT	SLIGHT		SLIGHT-MED.
UNIFIED SOIL CLASSIFICATION	MH	MH		MH
APPARENT SPECIFIC GRAVITY				
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				41.7
Molding Dry Density, P.C.F.				79.1
Swell upon saturation, %				0.3
CBR at 0.1" Penetration				22.0
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By BT

WOODLAND ESTATES

TABLE IH - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	24	24	27	27
SAMPLE NO.	E	H (BTM.)	B	D
DEPTH BELOW SURFACE	15'-16'	30'-31.5'	5'-6.5'	15'-16'
DESCRIPTION	LIGHT BROWN CLAYEY SILT W/SOME DECOMP. ROCK	BROWN & BLACK CLAYEY SILT	LIGHT MOTTLED BROWN CLAYEY SILT	GRAY, BROWN & BLACK CLAYEY SILT (DECOMP. ROCK)
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	83	65	66	61
Plastic Limit	53	50	50	50
Plasticity Index	30	15	16	11
Dilatancy	MED.-QUICK	MED.-QUICK	QUICK	MED.-QUICK
Toughness	SLIGHT	MEDIUM	SLIGHT	SLIGHT
Dry Strength	SLIGHT-MED.	SLIGHT-MED.	SLIGHT-MED.	SLIGHT
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	MH
APPARENT SPECIFIC GRAVITY				
CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

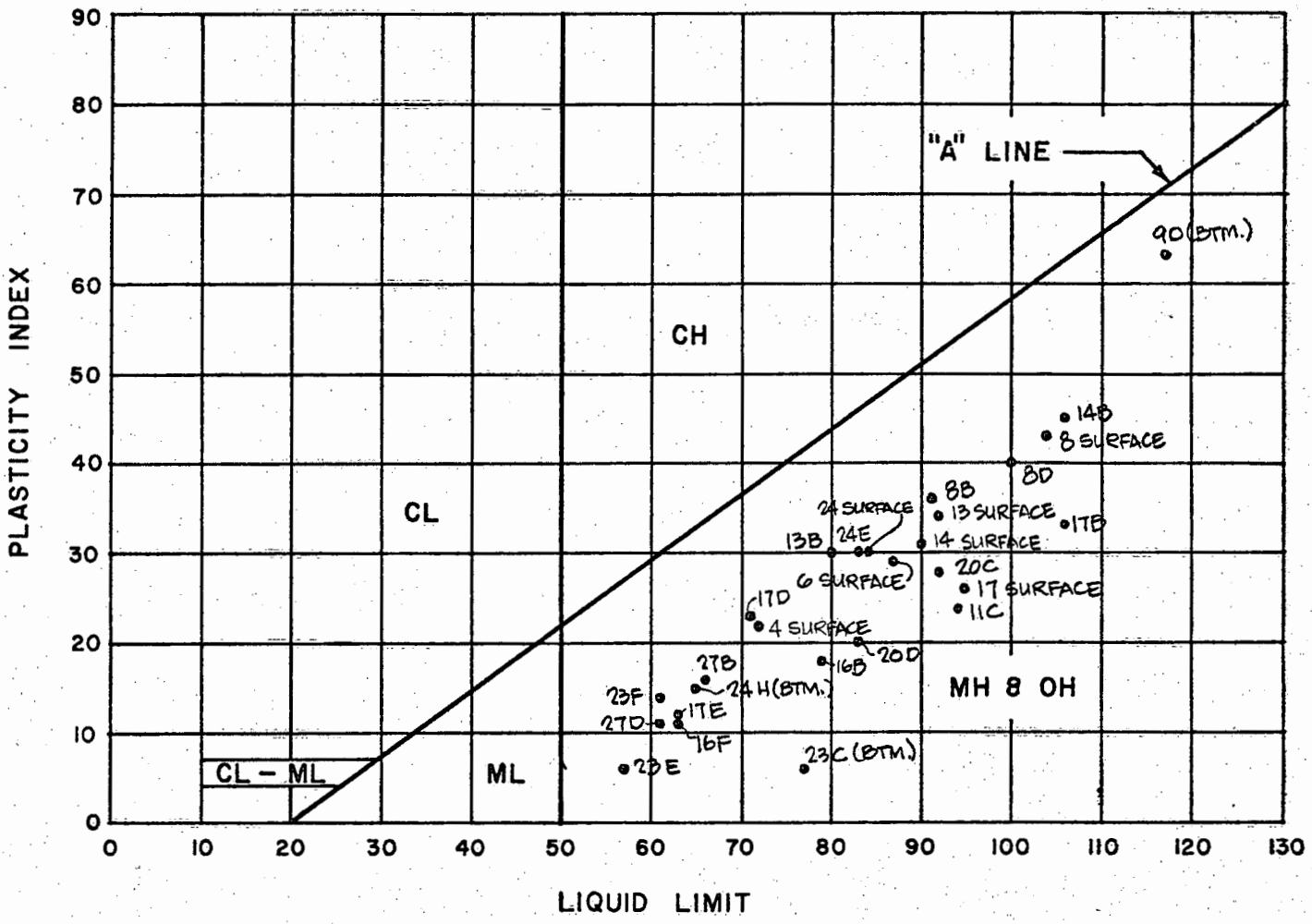
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 11-19-73 By BT

PLASTICITY CHART

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII



DATE 11-19-73 BY BT

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

8-872

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

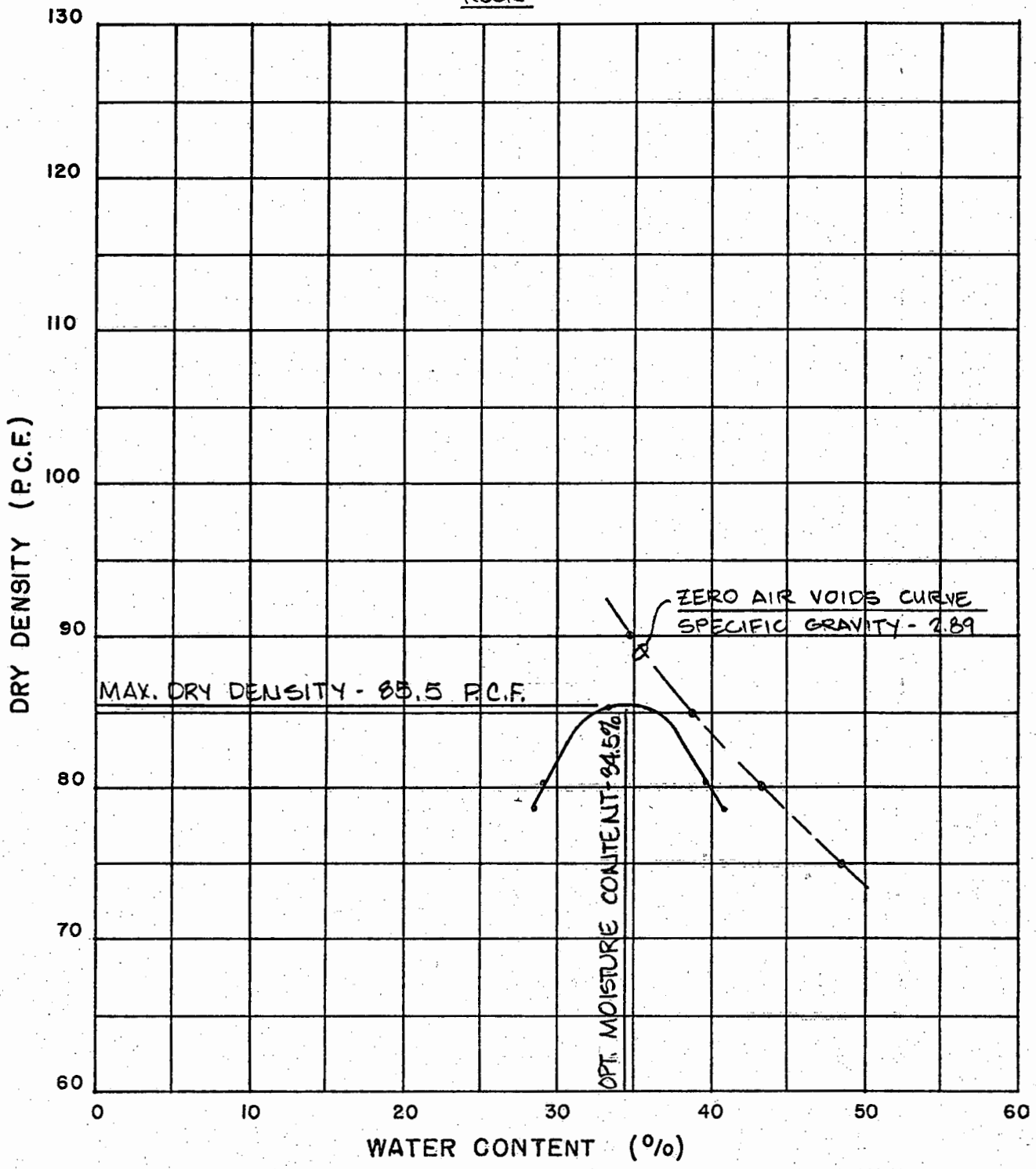
PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO.: 4 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/DECOMP. ROCK

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4"ϕ X 4.584" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 11-9-73 BY MI

9-470

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

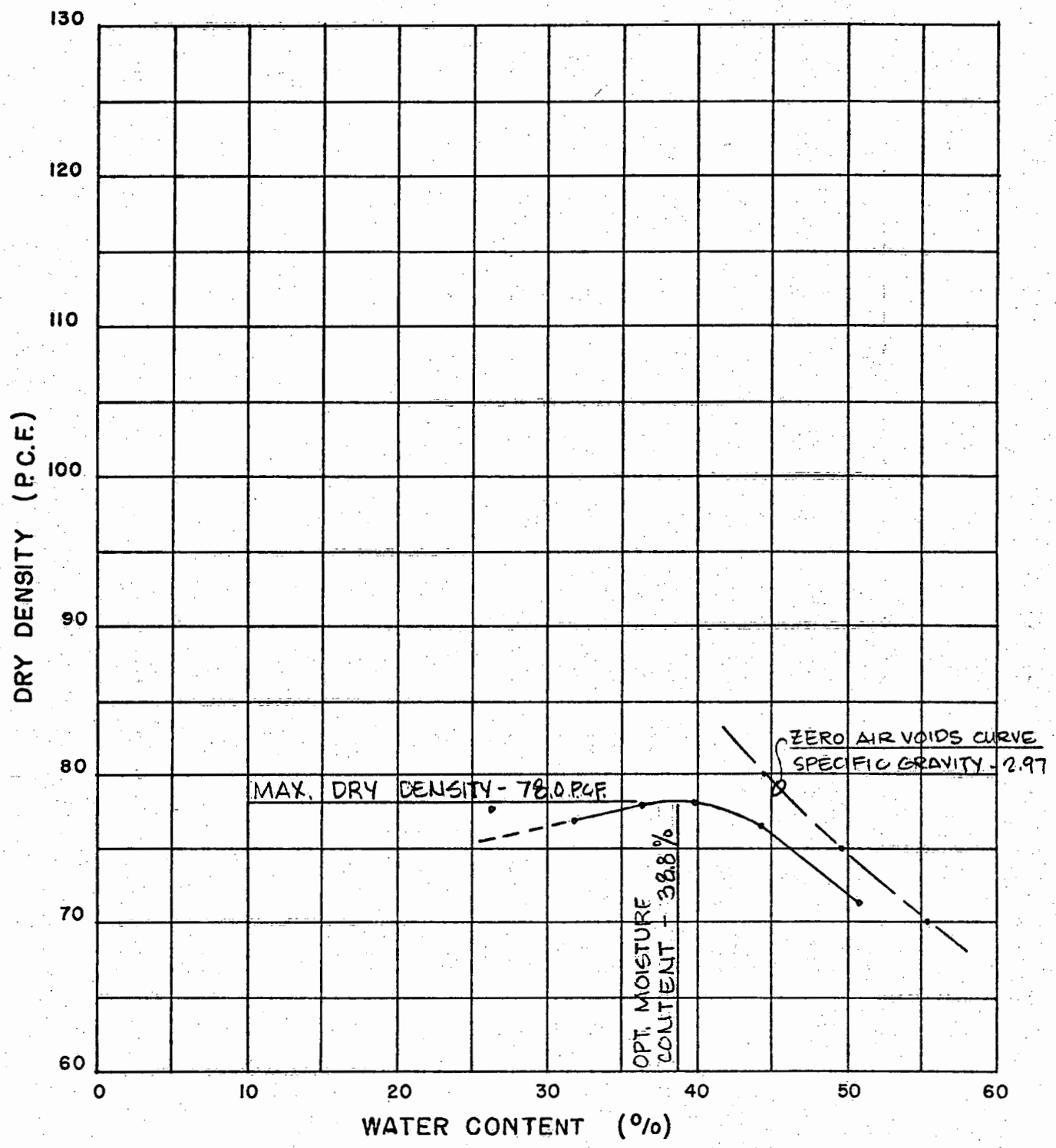
PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO.: 6 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4"ϕ X 4.584" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 11-16-73 BY NI

9-470

MOISTURE-DENSITY CURVE (AASHO T-180-57, METHOD A)

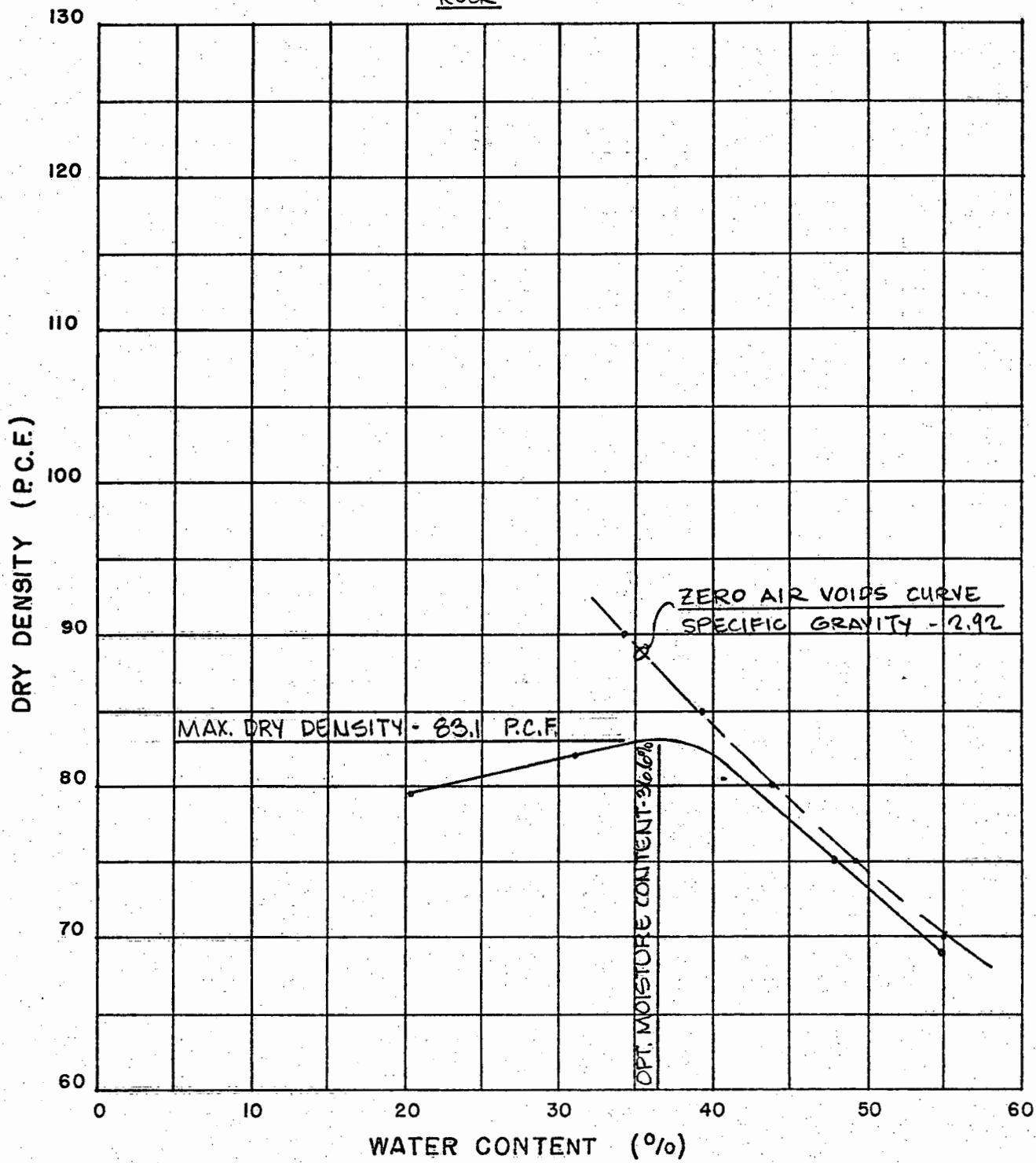
PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO.: B SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/DECOMP. ROCK

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4"Φ X 4.584" HIGH
HAMMER: 10 LBS 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 11-12-73 BY NI

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

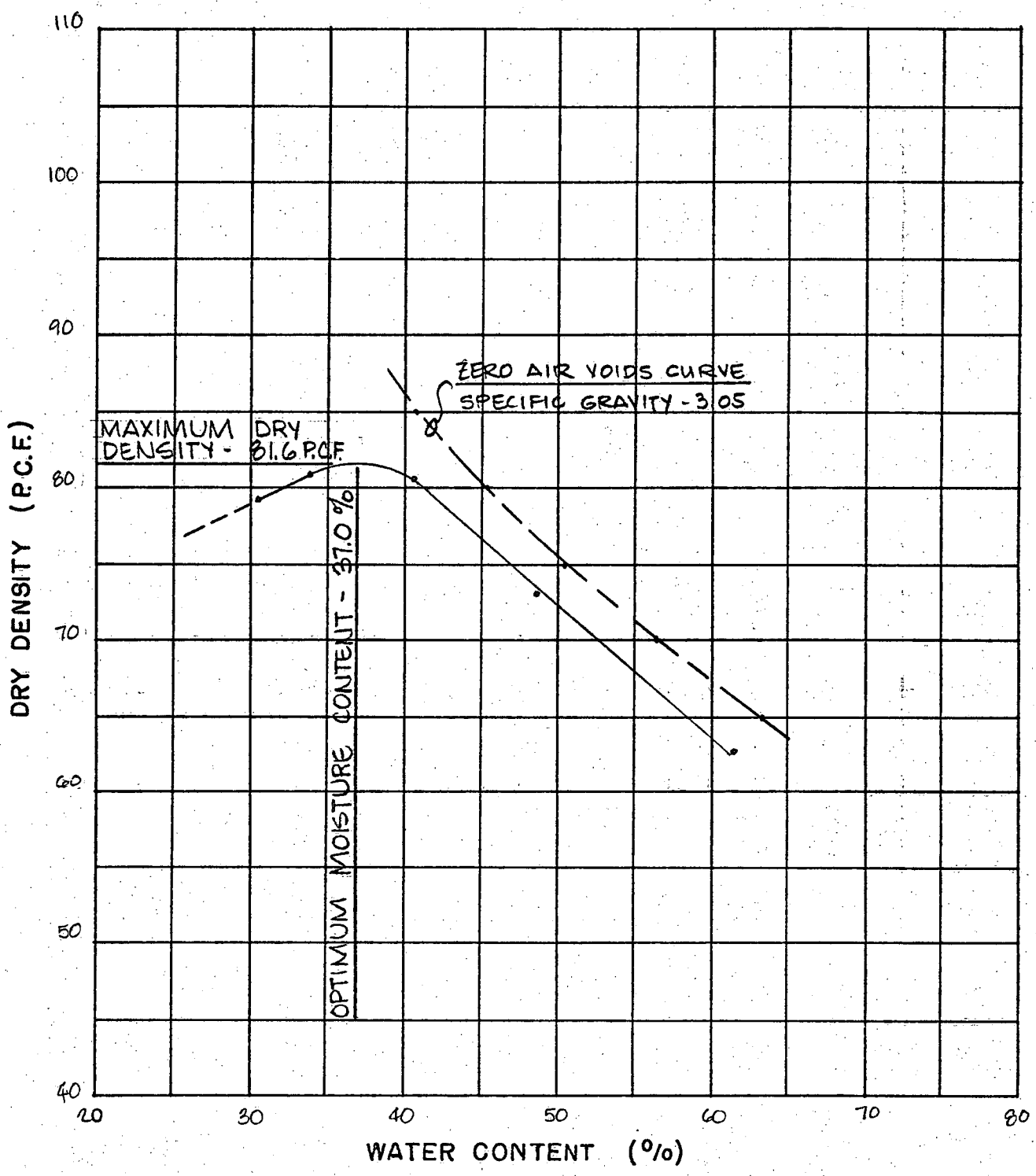
PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO.: 13 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" ϕ X 4.584" HIGH
HAMMER: 10 LBS. 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 10-31-73 BY NI

9-470

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO.: 14 SURFACE

SAMPLE DESCRIPTION: MOTTLED BROWN CLAYEY SILT

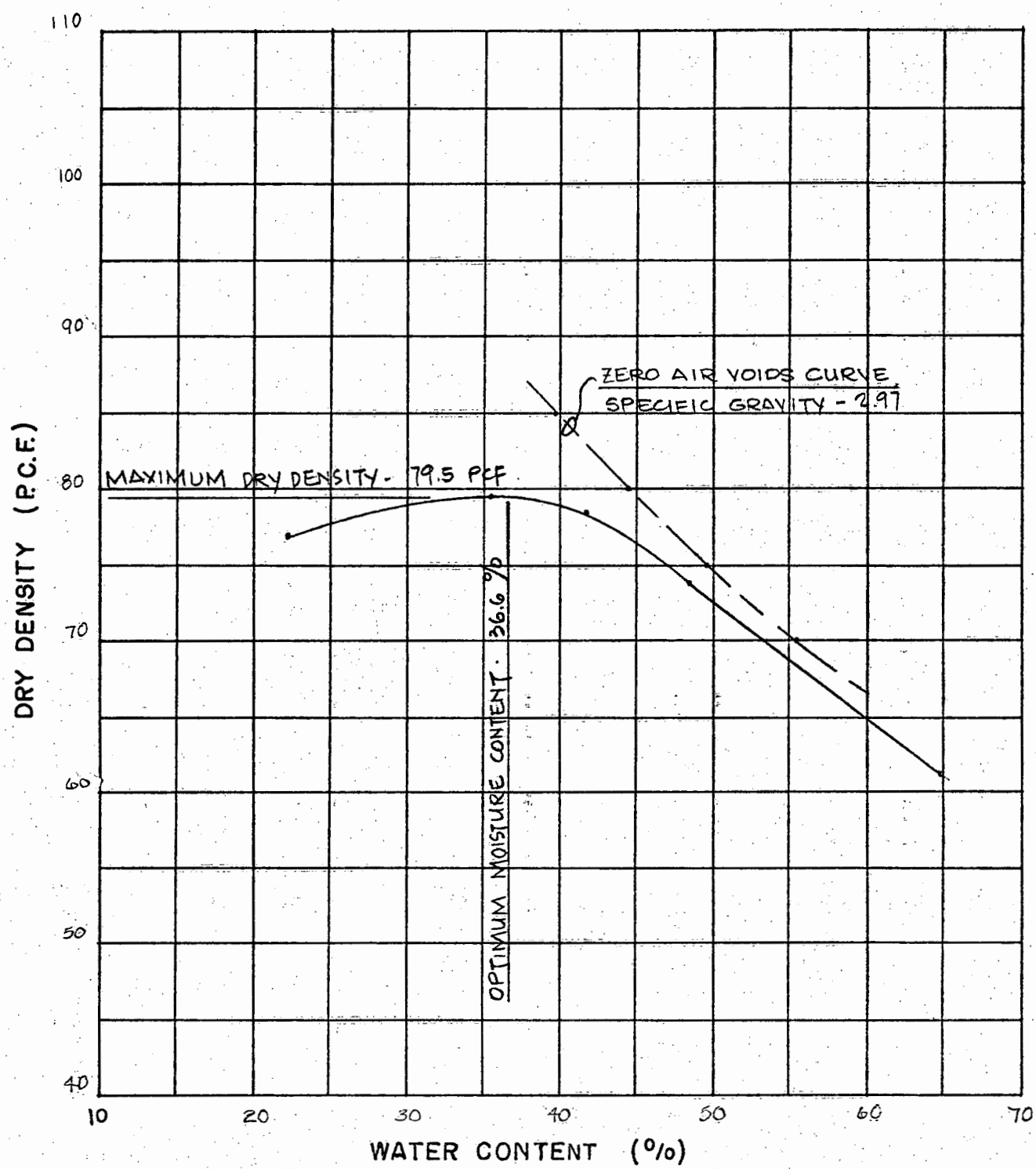
AGGREGATE: 1/4" MINUS

MOLD SIZE: 4"Ø X 4.584" HIGH

HAMMER: 10 LBS 18" DROP

LAYERS: 5

BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE _____ BY _____

MOISTURE–DENSITY CURVE (AASHO T-180-57, METHOD A)

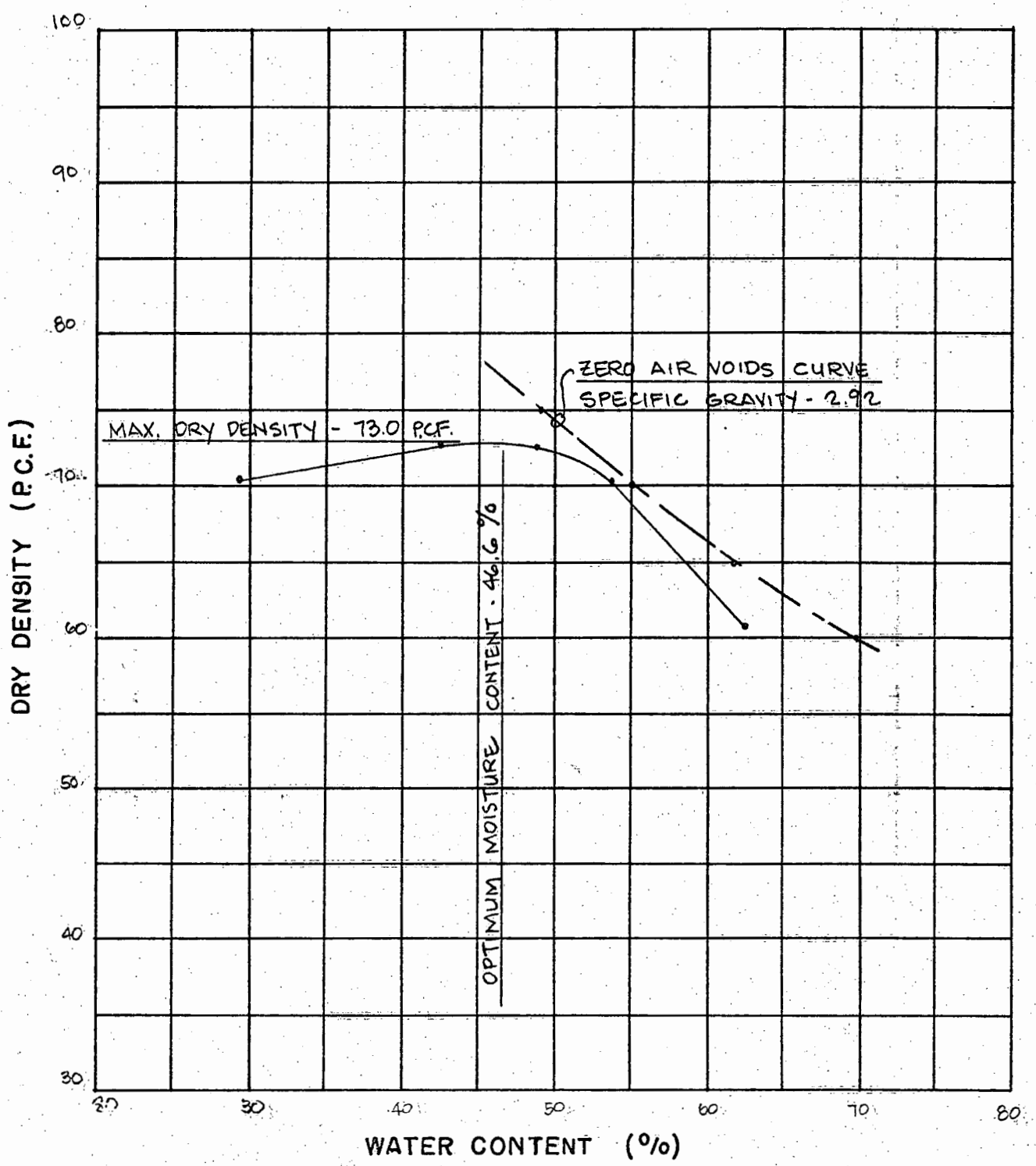
PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO.: 17 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4"ϕ X 4.584
HAMMER: 10 LBS. 18" DROP
LAYERS: 5
BLOWS: 25/LAYER



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE _____ BY _____

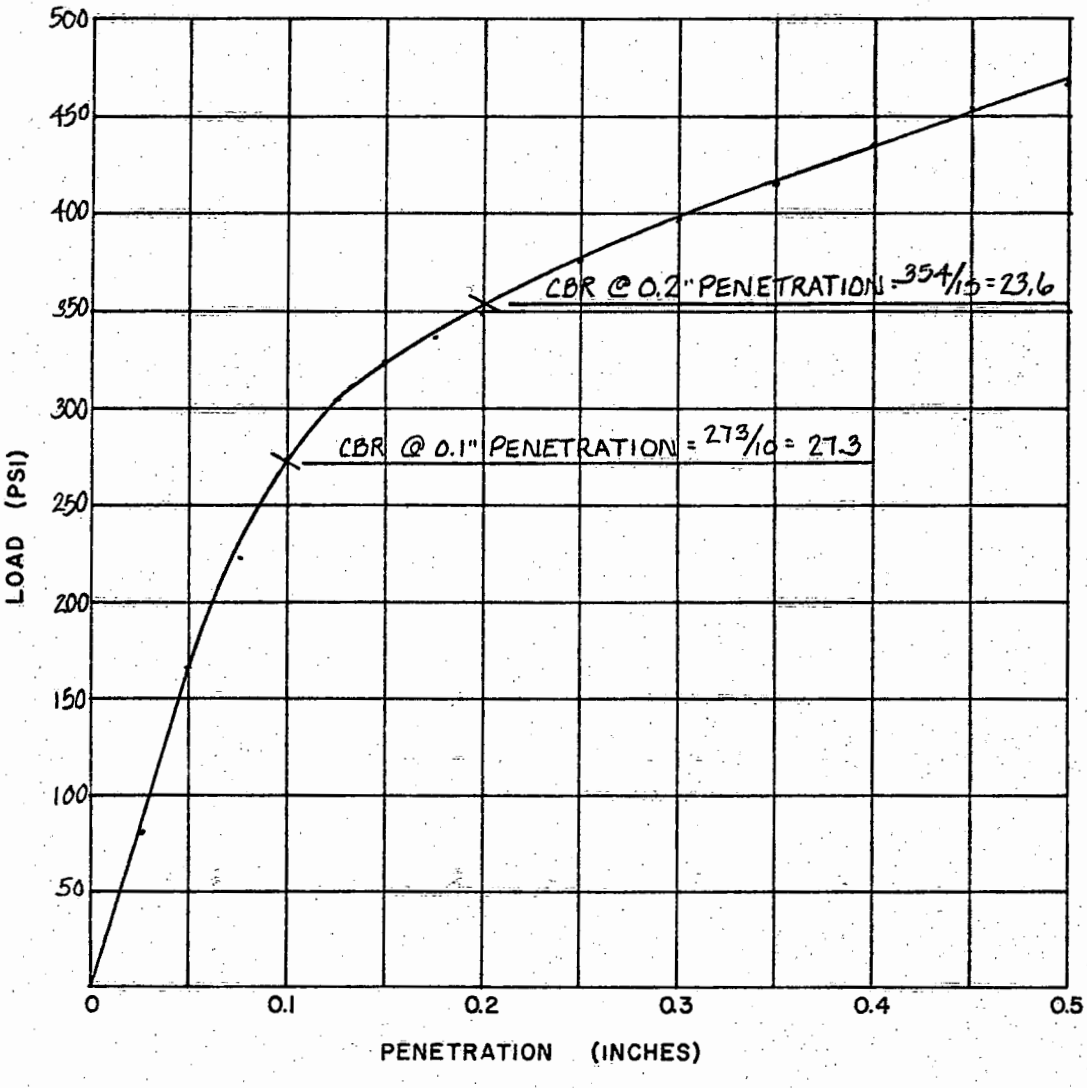
CBR TEST

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: 4 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/DECOMP. ROCK



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	240	80
0.050	490	163
0.075	670	223
0.100	820	273
0.125	910	303
0.150	970	323
0.175	1010	337
0.200	1050	350
0.250	1130	377
0.300	1190	397
0.350	1250	417
0.400	1310	437
0.450	1360	453
0.500	1400	467

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LB.

HAMMER DROP 18 IN.

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 38.4

MOLDING DRY DENSITY, P.C.F. 81.9

CBR @ 0.1" PENETRATION 27.3

DAYS SOAKED 4

DATE 11-6-73 BY RH

DATE 11-7-73 BY JS

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

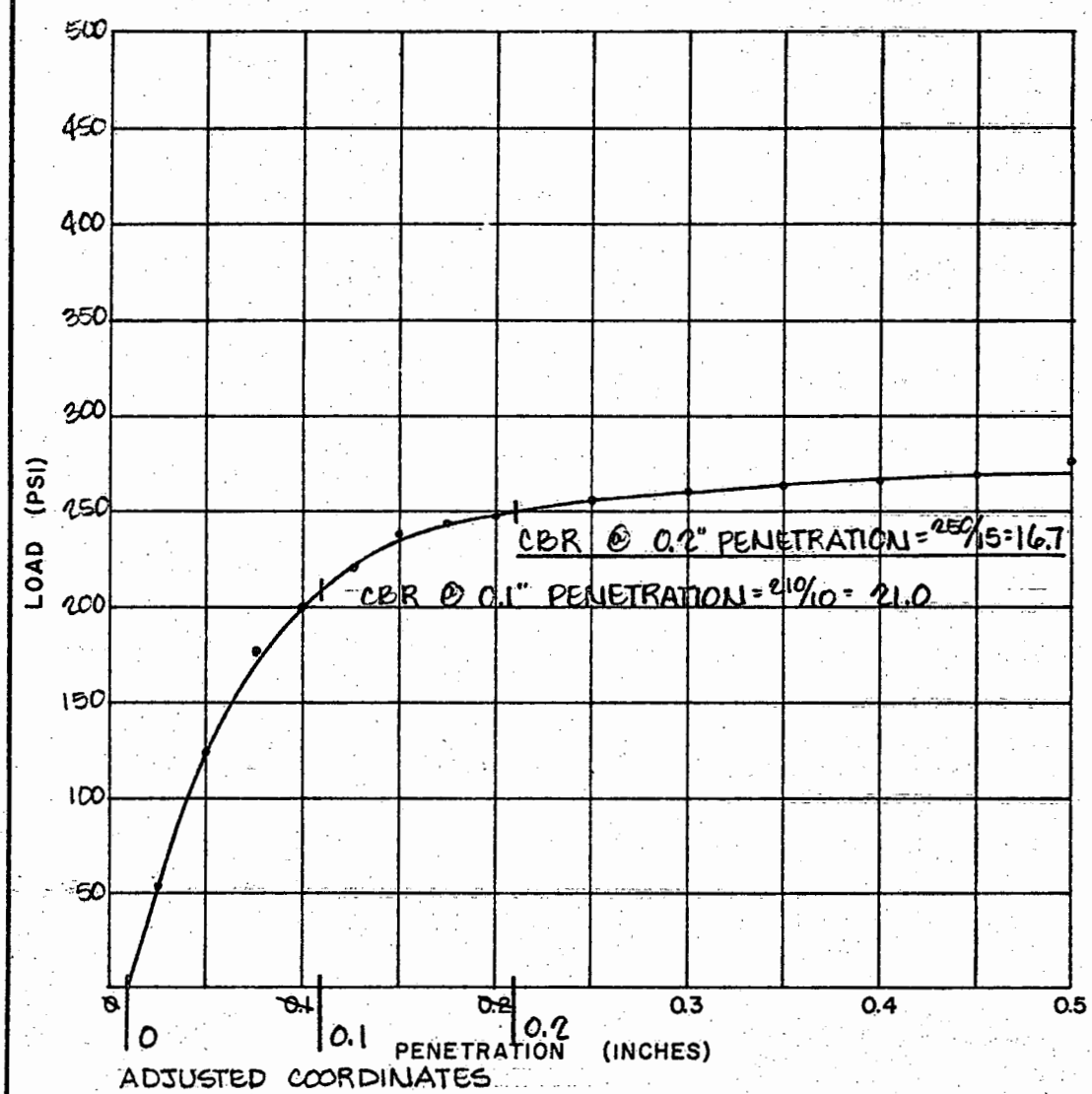
CBR TEST

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: 6 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	160	53
0.050	370	123
0.075	530	177
0.100	600	200
0.125	660	220
0.150	710	237
0.175	730	243
0.200	740	247
0.250	770	257
0.300	780	260
0.350	790	263
0.400	800	267
0.450	810	270
0.500	830	277

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18 INS

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 44.0

MOLDING DRY DENSITY, P.C.F. 79.1

CBR @ 0.1" PENETRATION 21.0

DAYS SOAKED 4

DATE 11-12-73 BY RH

DATE 11-13-73 BY NI

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

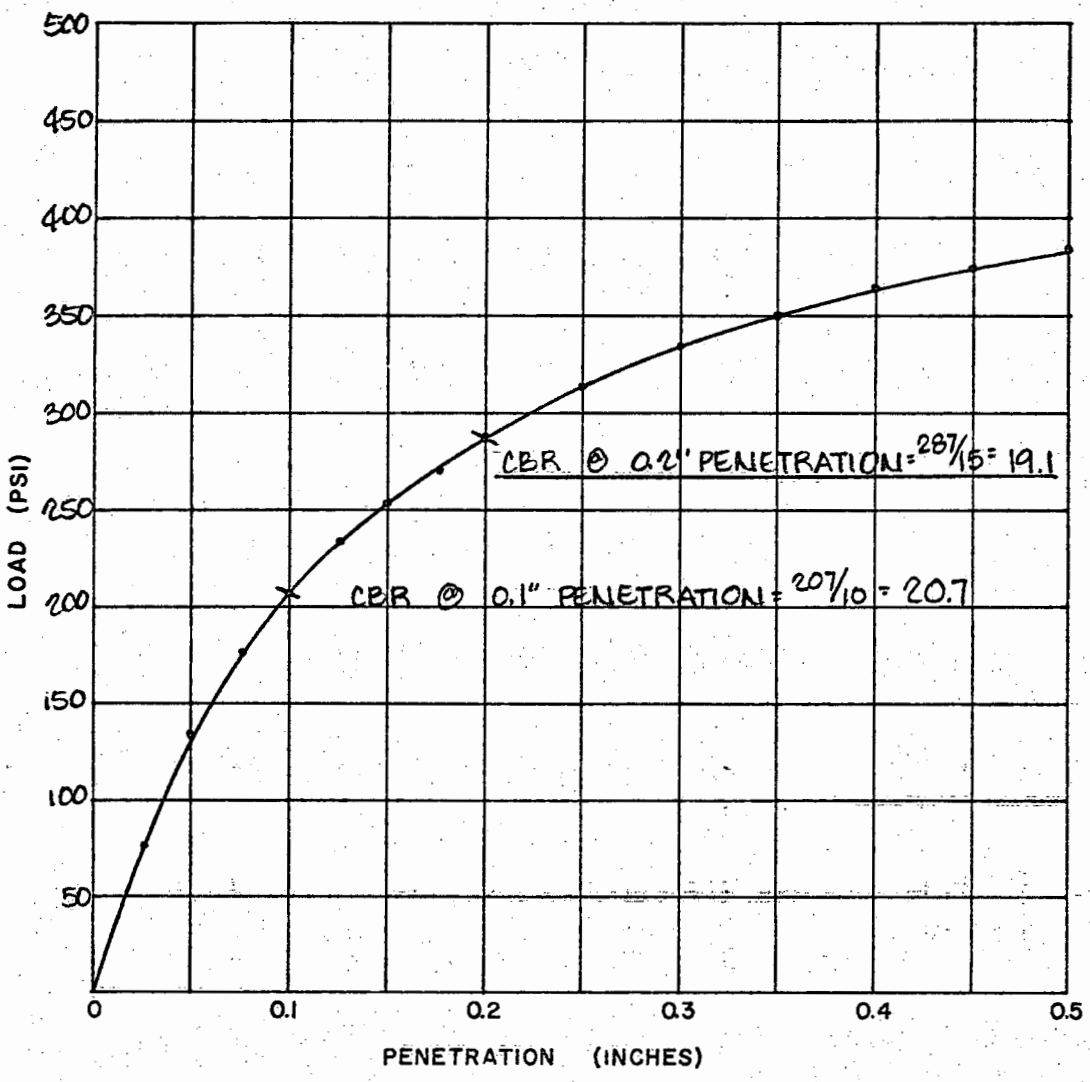
CBR TEST

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: B SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/DECOMP. ROCK



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	230	77
0.050	400	133
0.075	530	177
0.100	620	207
0.125	700	233
0.150	760	253
0.175	810	270
0.200	860	287
0.250	940	313
0.300	1000	333
0.350	1050	350
0.400	1090	363
0.450	1120	373
0.500	1150	383

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18 INS

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 46.7

MOLDING DRY DENSITY, P.C.F. 75.7

CBR @ 0.1" PENETRATION 20.7

DAYS SOAKED 4

DATE 11-17-73 BY T.K.

DATE 11-19-73 BY N.I.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

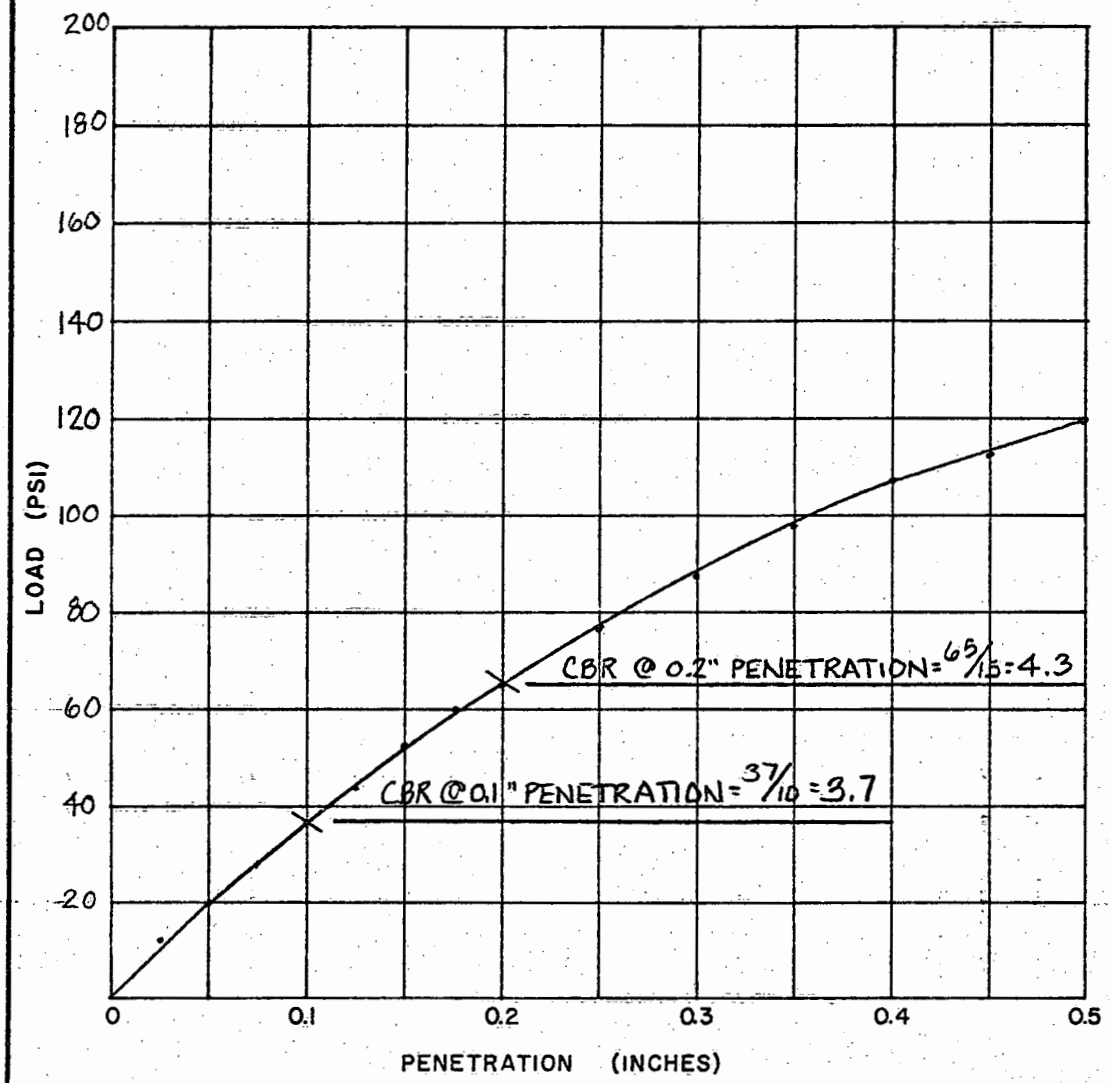
CBR TEST

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: 13 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	35	12
0.050	60	20
0.075	85	28
0.100	110	37
0.125	130	43
0.150	155	52
0.175	180	60
0.200	195	65
0.250	230	77
0.300	265	88
0.350	295	98
0.400	320	107
0.450	340	113
0.500	360	120

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 51.1

MOLDING DRY DENSITY, P.C.F. 69.4

CBR @ 0.1" PENETRATION 3.7

DAYS SOAKED 4

DATE 10-31-73 BY CL

DATE 11-1-73 BY JS

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

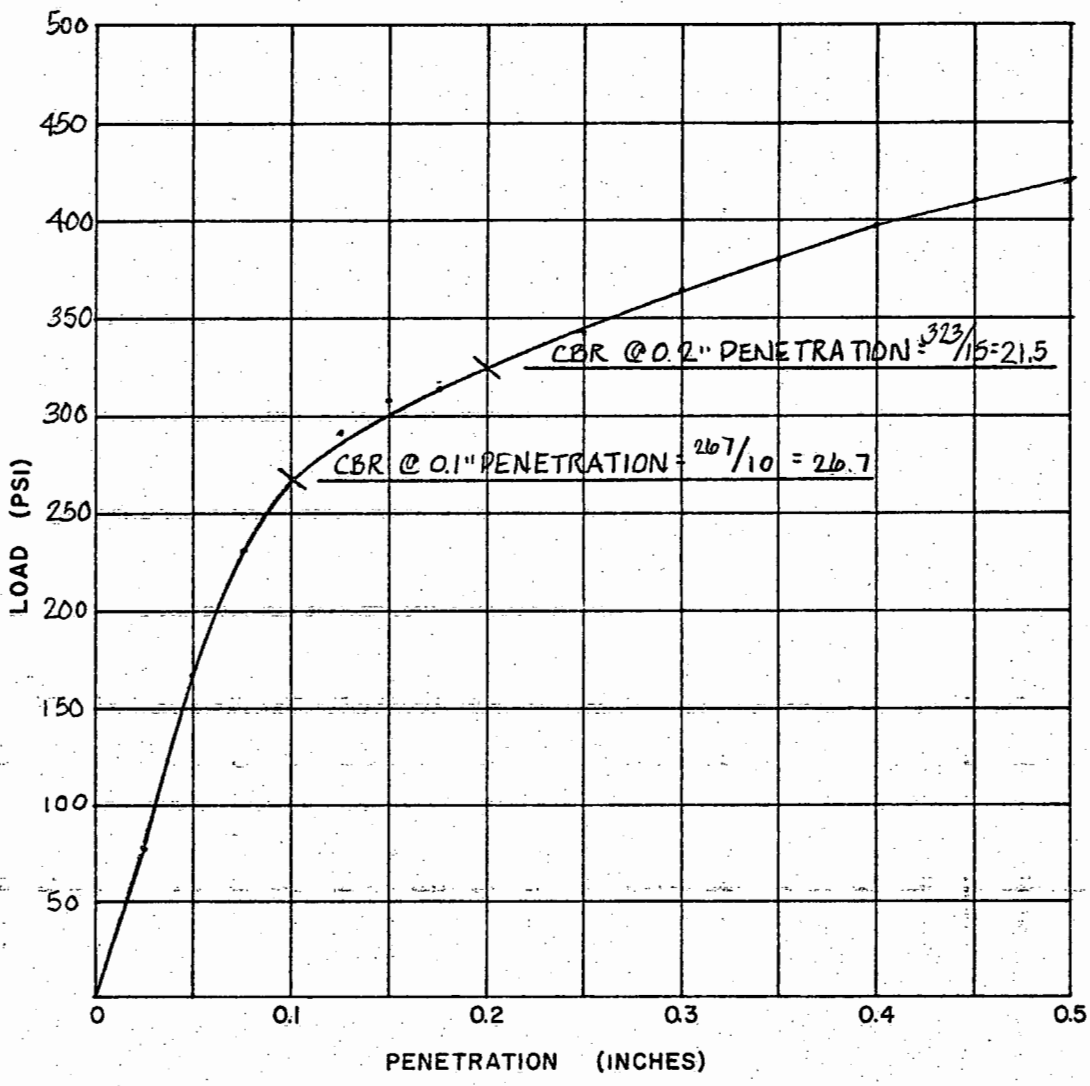
CBR TEST

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: 14 SURFACE

SAMPLE DESCRIPTION: MOTTLED BROWN CLAYEY SILT W/DECOMP. ROCK



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	230	77
0.050	500	167
0.075	690	230
0.100	800	267
0.125	870	290
0.150	920	307
0.175	940	313
0.200	970	323
0.250	1025	342
0.300	1090	363
0.350	1140	380
0.400	1190	397
0.450	1230	410
0.500	1260	420

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 41.8

MOLDING DRY DENSITY, P.C.F. 78.9

CBR @ 0.1" PENETRATION 26.7

DAYS SOAKED 4

DATE 11-3-73 BY L.Y.

DATE 11-5-73 BY BT.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

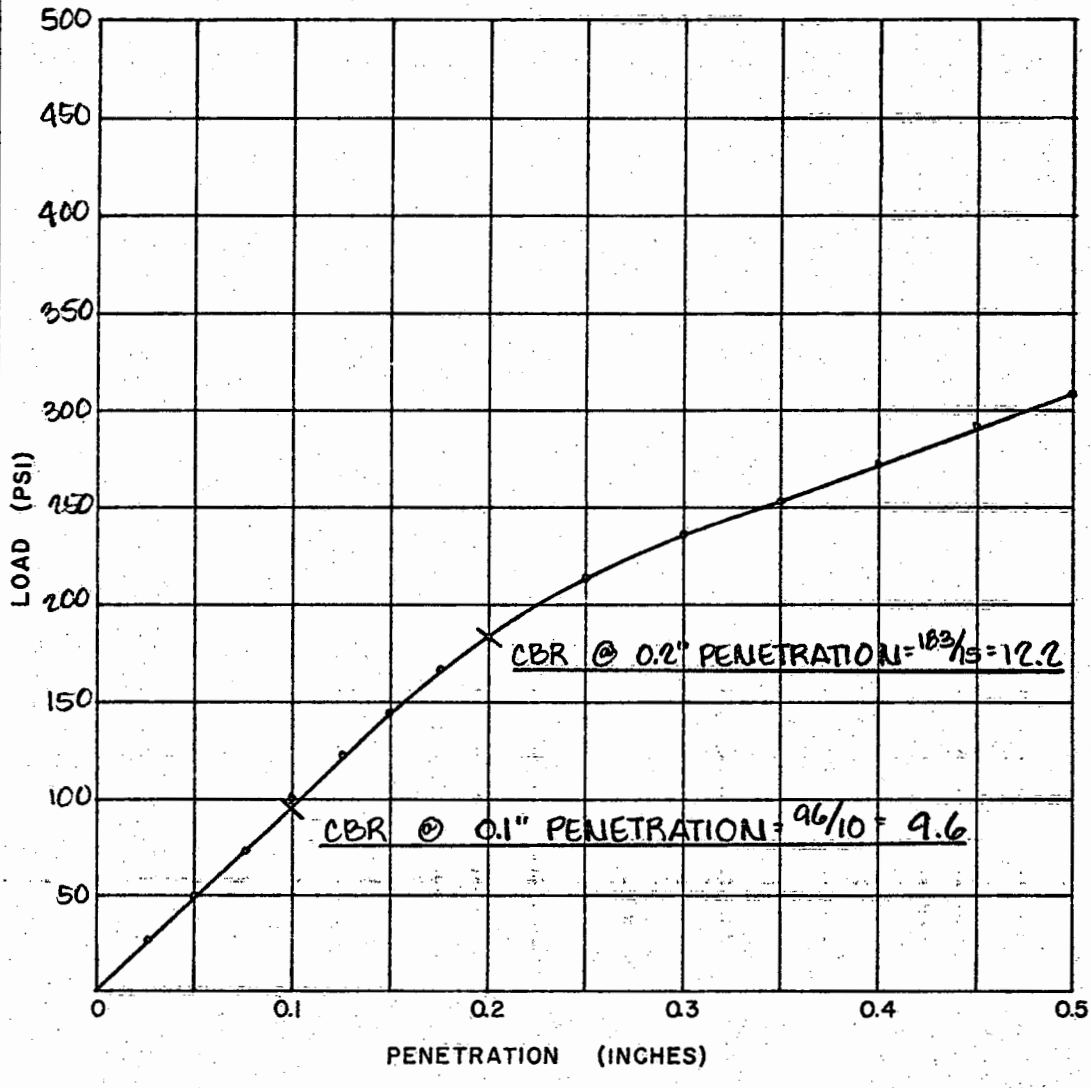
CBR TEST

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: 17 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	80	27
0.050	150	50
0.075	220	73
0.100	300	100
0.125	365	122
0.150	435	145
0.175	500	167
0.200	550	183
0.250	635	212
0.300	705	235
0.350	760	253
0.400	810	270
0.450	870	290
0.500	920	307

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 50.8

MOLDING DRY DENSITY, P.C.F. 71.1

CBR @ 0.1" PENETRATION 9.6

DAYS SOAKED 5

DATE 11-5-73 BY LY

DATE 11-6-73 BY NI

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

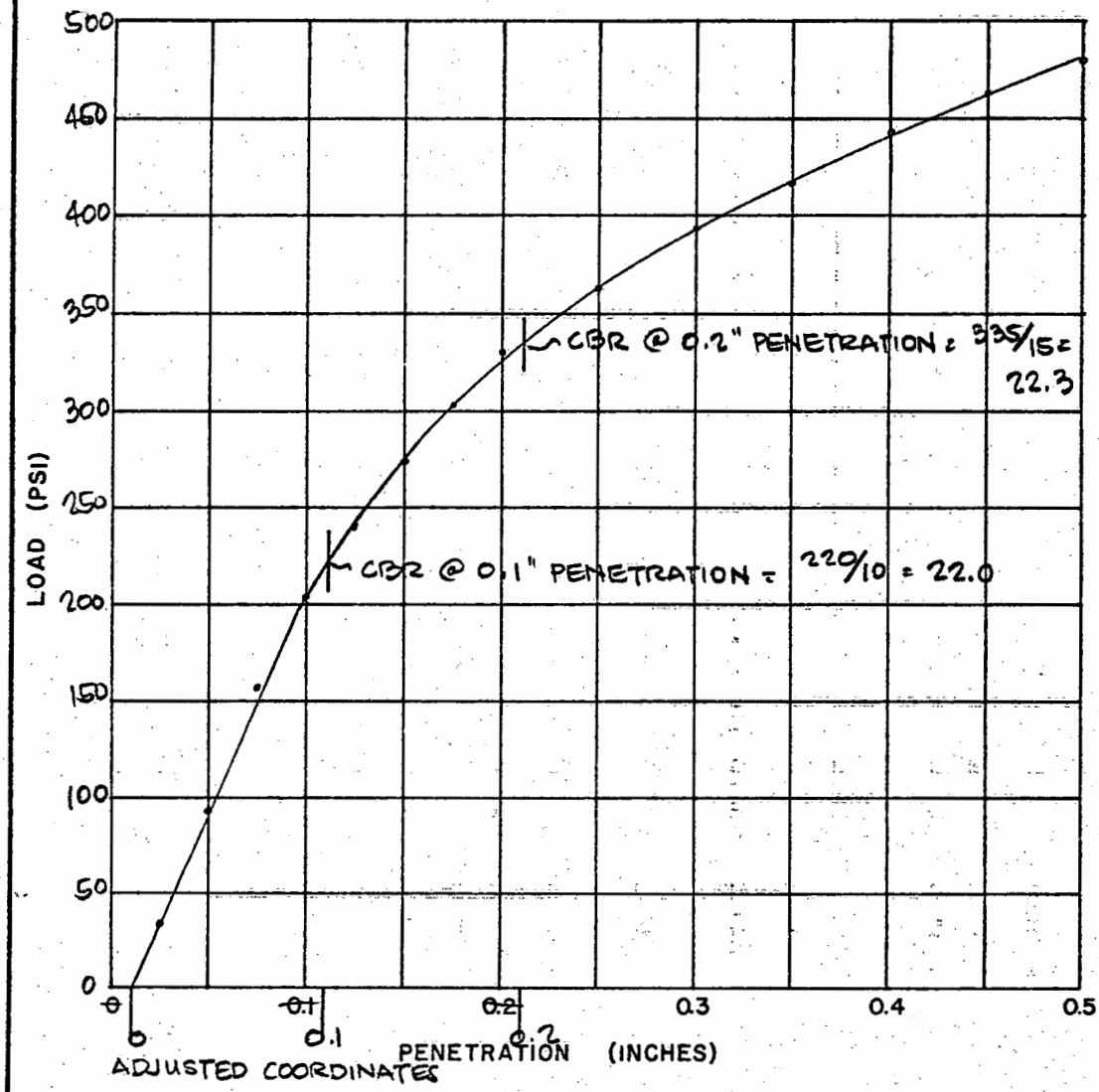
CBR TEST

PROJECT: WOODLAND ESTATES

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: 24 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT W/ROOTS



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	100	33
0.050	280	93
0.075	470	157
0.100	610	203
0.125	720	240
0.150	820	273
0.175	910	303
0.200	990	330
0.250	1090	363
0.300	1180	393
0.350	1250	417
0.400	1330	443
0.450	1390	463
0.500	1440	480

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LBS.

HAMMER DROP 18"

No. OF BLOWS 25/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 41.7

MOLDING DRY DENSITY, P.C.F. 79.1

CBR @ 0.1" PENETRATION 22.0

DAYS SOAKED 4

DATE 11-19-73 BY T.K.

DATE 11-19-73 BY B.T.

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

LOGS OF BORINGS

AND

LABORATORY TEST RESULTS

FROM

"KALIHI SUBDIVISION - HORITA"

SOIL RECONNAISSANCE REPORT

DATED JULY 18, 1972

KALIHI HORITA

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: KALIHI SUBDIVISION - HORITA
LOCATION: Kalihi Valley, Oahu, Hawaii
TMK: 1-4-14: 26 & 1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 1 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: MAY 18, 1972
Field Party: KAKU, MAESHIRO
Type of Boring: AUGER (MOBILE B-30) Diam.: 4"
Elev.: 533'± * Datum: ____
Drill Bit: FINGER TYPE

Water Level	5.0'			
Time	3:35 PM			
Date	5-19-72			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 533'± *	0								
(MH)	STIFF, MOTTLED TAN BROWN, CLAYEY SILT W/ DECOMPOSED ROCK & COBBLES OR BOULDERS			1-A	—	42	—	—	—	20/0.5' → 10/0.0' HAMMER BOUNCES
		5	WATER 5-19-72	1-B	—	50	—	—	—	
(MH)	STIFF, MOTTLED TAN BROWN SANDY SILT W/ DECOMPOSED ROCK	10		1-C	—	56	—	—	—	
(SM)	MEDIUM DENSITY GRAY BROWN SILTY SAND W/ DECOMPOSED ROCK	15		1-D	—	52	—	—	—	
	COBBLE OR BOULDER	20		1-E		NO RECOVERY				50/0.0' HAMMER BOUNCES
	END OF BORING @ 20'									

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR. INC.

6-26-72

KALIHI HORITA

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: KALIHI SUBDIVISION - HORITA
LOCATION: Kalihi Valley, Oahu, Hawaii
TMK: 1-4-14: 26 & 1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" S - 2" O.D. THIN WALL TUBE; 2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 2 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: MAY 19, 1972
Field Party: KAKU, MAESHIRO
Type of Boring: AUGER (MOBILE B-30) Diam.: 4"
Elev.: 563'± * Datum: —
Drill Bit: FINGER TYPE

Water Level	12.0'			
Time	3:30 PM			
Date	5-19-72			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 563'± *	0									
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT W/ TRACES OF ROOTS		2"S	2-A	93	64	57	2580	—		2/0.5' 3/0.5'
MH	MEDIUM, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	5	2"S	2-B	108	58 LL= 80 PL= 59	68	1360	—		1/0.5' 4/0.5'
		10	2"SS	2-C	—	62	—	—	—		
	WATER 5-19-72										
(MH)	STIFF, MOTTLED BROWN & WHITE CLAYEY SILT W/ SAND, & DECOMPOSED ROCK	15	2"S	2-D	125	62	77	2060	—		2/0.5' 5/0.5'
(MH)	MOTTLED BROWN SILTY SAND W/ DECOMPOSED ROCK	20	2"SS	2-E	—	61	—	—	—		4/0.5' 30/0.1' HAMMER BOUNCES
	END OF BORING @ 21.1'										

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

KALIHI HORITA

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: KALIHI SUBDIVISION - HORITA
LOCATION: Kalihi Valley, Oahu, Hawaii
TMK: 1-4-14: 26 & 1-4-16: 3

HAMMER:
Weight: 140 #
Drop: 30"
SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 3 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date MAY 17, 1972
Field Party KAKU, MAESHIRO
Type of Boring AUGER (MOBILE B-30) Diam. 4"
Elev. 608' ± * Datum —
Drill Bit FINGER TYPE

Water Level	23.5'			
Time	2:30 PM			
Date	5-17-72			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 608' ± *	0									
MH	STIFF, BROWN CLAYEY SILT		2"S	3-A	104	55 LL= 96 PL= 67	67	6660	—		4/0.5' 8/0.5'
(MH)	STIFF, BROWN W/TRACES OF GRAY CLAYEY SILT	5	2"S	3-B	96	66	58	3660	—		3/0.5' 8/0.5'
(MH)	MEDIUM, MOTTLED TAN CLAYEY SILT W/ DECOMPOSED ROCK	10	2"SS	3-C	—	73	—	—	—		
MH	SOFT TO MEDIUM MOTTLED TAN-RED CLAYEY SILT W/ DECOMPOSED ROCK	15	2"S	3-D	94	90 LL= 77 PL= 65	49	1830	—		1/1.0'
		20	2"SS	3-E	—	84	—	—	—		
			WATER 5-17-72								
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT W/ DECOMPOSED ROCK	25	2"SS	3-F	—	74	—	—	—		
	END OF BORING @ 26.5'										
	* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.										

KALIHI HORITA

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: KALIHI SUBDIVISION - HORITA
LOCATION: Kalihi Valley, Oahu, Hawaii
TMK: 1-4-14: 26 & 1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 4 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date MAY 18, 1972
Field Party KAKU, MAESHIRO
Type of Boring AUGER (MOBILE B-30) Diam. 4"
Elev. 577'± * Datum —
Drill Bit FINGER TYPE

Water Level	NOT NOTICED				
Time	—				
Date	5-18-72				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test, N (Blows per foot) 0 10 20 30 40
	ELEV. = 577'± *	0								
(MH)	MEDIUM MOTTLED TAN BROWN CLAYEY SILT	5		4-A	–	67	–	–	–	
				4-B	–	87	–	–	–	2/0.5' 5/0.5'
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/ DECOMPOSED ROCK	10		4-C	–	75	–	–	–	
	DECOMPOSED BLACK CINDERS (SOME CRUSHES TO SILTY SAND)	15		4-D	–	59	–	–	–	
	DECOMPOSED CINDERS W/SOME TAN VOLCANIC CLAY (SOME CRUSHES TO CLAYEY SILT)	20		4-E	–	127 LL= 125 PL= 91	–	–	–	
	END OF BORING @ 21.5'									

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

KALIHI HORITA

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: KALIHI SUBDIVISION - HORITA
LOCATION: Kalihi Valley, Oahu, Hawaii
TMK: 1-4-14: 26 & 1-4-16: 3

HAMMER:
Weight: 140*
Drop: 30"
SAMPLER: 2" SS - 2" O.D. THIN WALL TUBE
2" SS - 2" STANDARD SPLIT SPOON

BORING NO. 5 Sheet No. ____ of ____
Driller: W. LUM ASSOC., INC. Date: MAY 19, 1972
Field Party: GLORY, RADOVICH, TAHOUYE
Type of Boring: AUGER (MOBILE MINUTEMAN) Diam.: 3"
Elev.: 652'± * Datum: —
Drill Bit: CLAY

Water Level					
	NOT NOTICED				
Time	—				
Date	5-19-72				

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
	ELEV. = 652'± *	0									
(MH)	MEDIUM, MOTTLED BROWN CLAYEY SILT W/ TRACES OF DECOMPOSED ROCK		2"S	S-A	99	58	63	1920	—		2/0.5' 2/0.5'
(MH)	SOFT, MOTTLED BROWN CLAYEY SILT W/ TRACES OF DECOMPOSED ROCK	5									
MH	SOFT, GRAY & BROWN CLAYEY SILT W/ ROOTS		2"SS	S-B	— (MIDDLE)	66 89 LL= PL=	— 113 59	—	—	2/1.5'	
(MH)	SOFT, MOTTLED BROWN CLAYEY SILT W/ TRACES OF DECOMPOSED ROCK										
MH	STIFF, REDDISH BROWN CLAYEY SILT	10	2"S	S-C	101	60 LL= 118 PL= 64	63	6330	—		3/0.5' 4/0.5'
MH	STIFF, MOTTLED BROWN CLAYEY SILT W/ DECOMPOSED ROCK	15	2"SS	S-D	—	68	—	—	—		
		20	2"S	S-E	104 (TOP)	64 54 LL= PL=	— 94 65	2630	—		6/0.5' 6/0.5'
(MH)	BROWN DECOMPOSED ROCK (SOME CRUSHES TO CLAYEY SILT)	25	2"SS	S-F	—	44	—	—	—		20/0.2' HAMMER BOUNCES
	END OF BORING @ 25.7'										

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

KALIHI HORITA

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: KALIHI SUBDIVISION - HORITA
LOCATION: Kalihi Valley, Oahu, Hawaii
TMK: 1-4-14: 26 & 1-4-16: 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2" SS-2" O.D. THIN WALL TUBE
2" SS-2" STANDARD SPLIT SPOON

BORING NO. 6 Sheet No. ____ of ____
Driller W. LUM ASSOC., INC. Date MAY 19, 1972
Field Party GLORY, RADOVICH, TANOUYE, KAKU, MAESHIRO
Type of Boring AUGER (MOBILE MINUTEMAN) Diam. 3"
Elev. 725'± * Datum —
Drill Bit CLAY

Water Level	NOT NOTICED				
Time	—				
Date	5-19-72				

Unified Soil Classification	DESCRIPTION ELEV. = 725'± *	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA: Standard Penetration Test N (Blows per foot) 0 10 20 30 40	PENETRATION DATA: 2" O.D. THIN WALL TUBE SAMPLER BLOWS/0.5'
(MH)	STIFF, BROWN CLAYEY SILT	0	2"S	G-A	101	56	64	4780	–		2/0.5' 4/0.5'
(MH)	MEDIUM TAN & MOTTLED BROWN CLAYEY SILT W/ DECOMPOSED ROCK	5	2"SS	G-B	–	54 46	–	–	–	3/0.5' 7/0.5'	
(MH)	STIFF, MOTTLED BROWN & ORANGE, CLAYEY SILT W/ DECOMPOSED ROCK										
MH	STIFF, MOTTLED REDDISH BROWN & GRAY CLAYEY SILT W/ DECOMPOSED ROCK	10	2"S	G-C	100	64 LL= 82 PL= 62	61	1690	–		2/0.5' 4/0.5'
		15	2"SS	G-D	–	60	–	–	–		
MH	STIFF, MOTTLED TAN & BROWN CLAYEY SILT W/ DECOMPOSED ROCK	20	2"S	G-E	104	64 LL= 76 PL= 60	64	1500	–		4/0.5' 5/0.5'
(MH)	STIFF, TAN CLAYEY SILT W/ DECOMPOSED ROCK	25	2"SS	G-F	–	66 90 65	–	–	–		
	STIFF, MOTTLED BROWN & RED CLAYEY SILT W/ DEC. ROCK										
	END OF BORING @ 26.5'										

* ELEVATION ESTIMATED FROM CONTOUR MAP BY PARK ENGR., INC.

KALIHI SUBDIVISION - HORITA

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	AREA "A"		2	
SAMPLE NO.			B	
DEPTH BELOW SURFACE	SURFACE		5'-6'	
DESCRIPTION	BROWN CLAYEY SILT		MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMP. ROCK	
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL		NATURAL	
Liquid Limit	63		80	
Plastic Limit	52		59	
Plasticity Index	11		21	
Dilatancy	QUICK		QUICK	
Toughness	SLIGHT		SLIGHT-MED.	
Dry Strength	SLIGHT		SLIGHT-MED	
UNIFIED SOIL CLASSIFICATION	MH		MH	
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %	39.9			
Molding Dry Density, P.C.F.	83.3			
Swell upon saturation, %	0.3			
CBR at 0.1" Penetration	23.5			
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 6-23-72 By BT

KALIHI SUBDIVISION - HORITA

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	3	3		4
SAMPLE NO.	A	D		E
DEPTH BELOW SURFACE	0.5' - 1.5'	15' - 16'		20' - 21.5'
DESCRIPTION	BROWN CLAYEY SILT	MOTTLED TAN-RED CLAYEY SILT W/DECOMP. ROCK		DECOMPOSED CINDERS W/SOME TAN VOLCANIC CLAY (SOME CRUSHES TO CLAYEY SILT)
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		NATURAL
Liquid Limit	96	77		125
Plastic Limit	67	65		91
Plasticity Index	29	12		34
Dilatancy	QUICK	QUICK		QUICK
Toughness	SLIGHT	SLIGHT		SLIGHT
Dry Strength	SLIGHT-MED.	SLIGHT-MED.		SLIGHT-MED.
UNIFIED SOIL CLASSIFICATION	MH	MH		MH
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 6-23-72 By BT

KALIHI SUBDIVISION - HORITA

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	5	5	5	
SAMPLE NO.	B (MIDDLE)	C	E (TOP)	
DEPTH BELOW SURFACE	5'-6.5'	9'-10'	20'-21'	
DESCRIPTION	GRAY & BROWN CLAYEY SILT W/ROOTS	REDDISH-BROWN CLAYEY SILT	MOTTLED BROWN CLAYEY SILT W/DECOMP ROCK	
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	113	118	94	
Plastic Limit	59	64	65	
Plasticity Index	54	54	29	
Dilatancy	NONE	MED.-QUICK	QUICK	
Toughness	MED.-HIGH	MEDIUM	SLIGHT-MED.	
Dry Strength	MEDIUM	MEDIUM	SLIGHT-MED.	
UNIFIED SOIL CLASSIFICATION	MH	MH	MH	
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 6-23-72 By BT

KALIHI SUBDIVISION - HORITA

TABLE I D - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	6	6		
SAMPLE NO.	C	E		
DEPTH BELOW SURFACE	10'-11'	20'-21'		
DESCRIPTION	MOTTLED REDDISH-BROWN & GRAY CLAYEY SILT W/DECOMP. ROCK	MOTTLED TAN-BROWN CLAYEY SILT W/DECOMP. ROCK		
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		
Liquid Limit	82	76		
Plastic Limit	62	60		
Plasticity Index	20	16		
Dilatancy	QUICK	QUICK		
Toughness	SLIGHT-MED.	SLIGHT		
Dry Strength	SLIGHT-MED.	SLIGHT-MED.		
UNIFIED SOIL CLASSIFICATION	MH	MH		
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

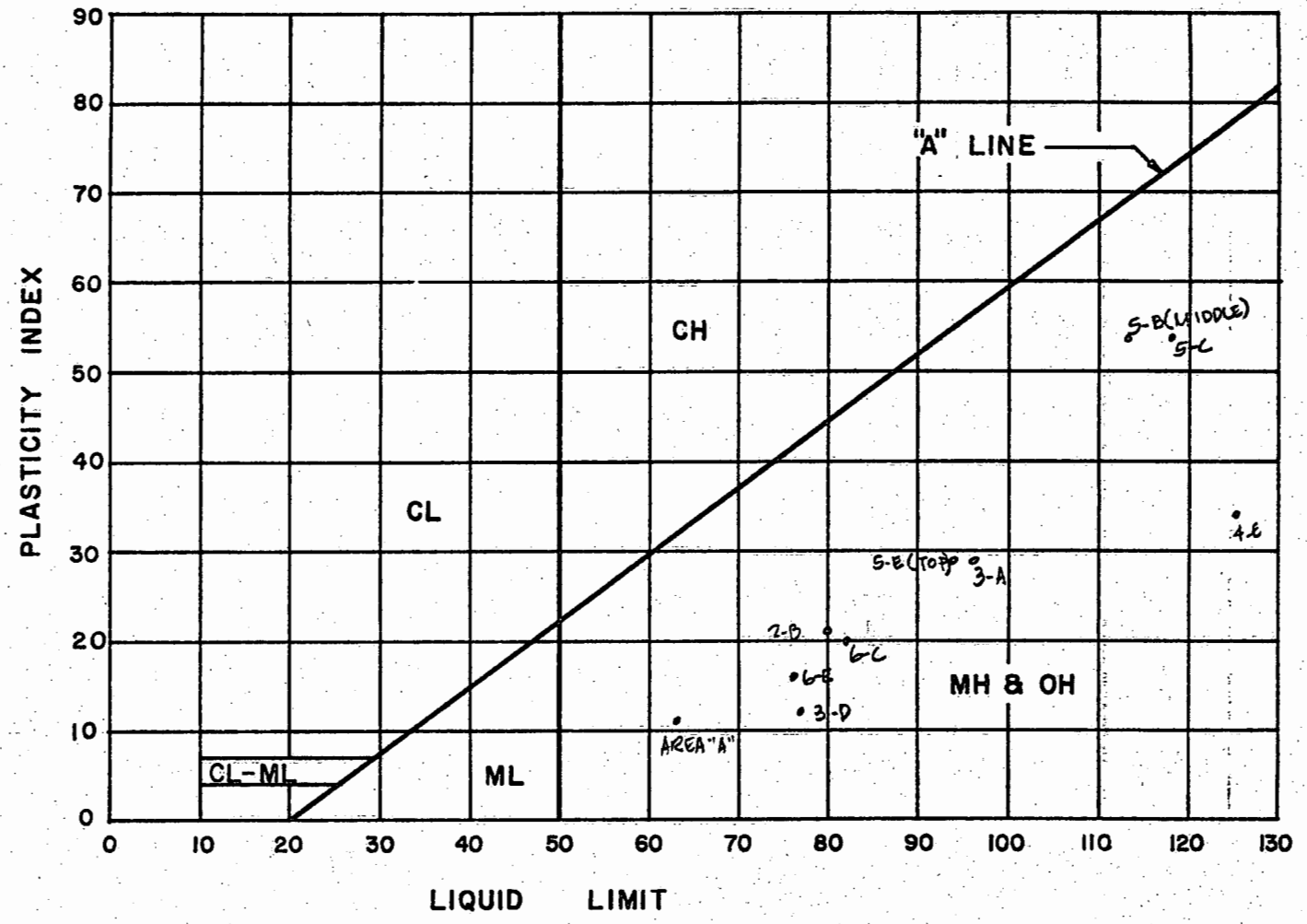
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 6-23-72 By BT

PLASTICITY CHART

PROJECT: KALIHI SUBDIVISION - HORITA

LOCATION: KALIHI VALLEY, OAHU, HAWAII



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 6-23-72 BY BT

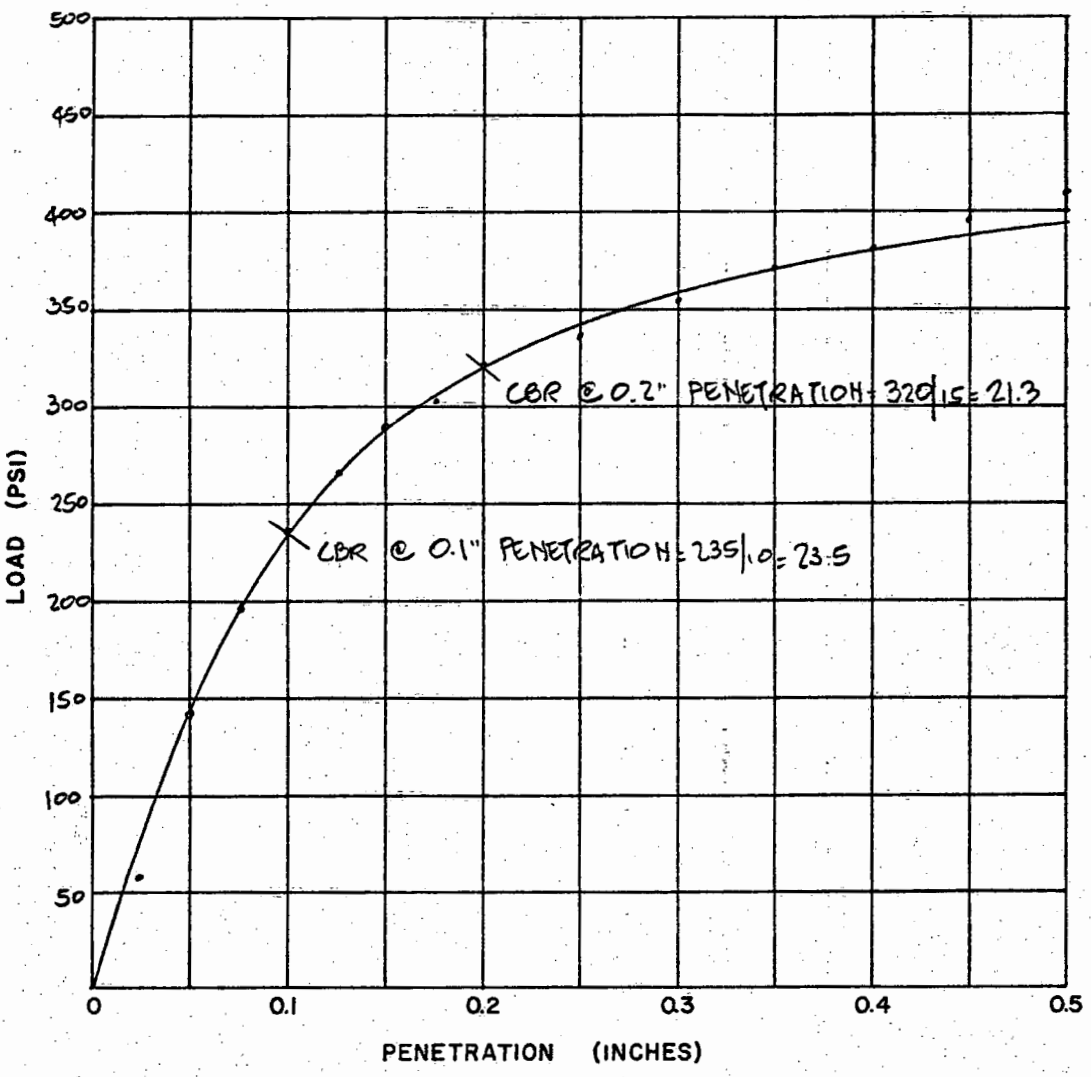
CBR TEST

PROJECT: KALIHI SUBDIVISION - HORITA

LOCATION: KALIHI VALLEY, OAHU, HAWAII

SAMPLE NO: "A" SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	175	58
0.050	430	143
0.075	590	197
0.100	710	237
0.125	800	267
0.150	870	290
0.175	910	303
0.200	970	323
0.250	1090	337
0.300	1065	355
0.350	1115	372
0.400	1150	383
0.450	1190	397
0.500	1230	410

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10LBS.

HAMMER DROP 18"

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 39.9

MOLDING DRY DENSITY, P.C.F. 83.3

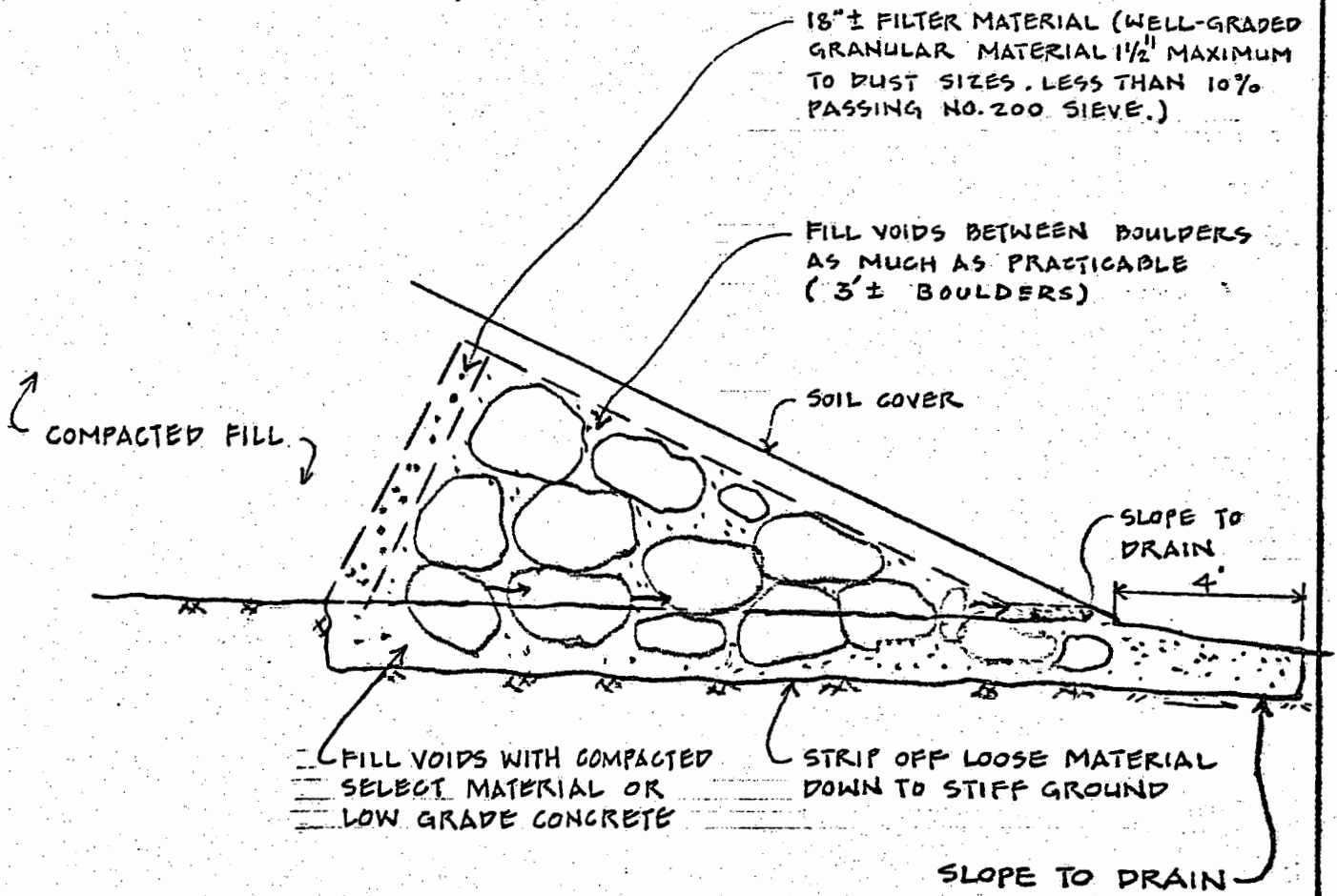
CBR @ 0.1" PENETRATION 23.5

DAYS SOAKED 4

DATE 5-22-72 BY LT

DATE 5-30-72 BY SK

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS



SECTION

NOT TO SCALE

FIGURE 1

PROPOSED BOULDER FILL

WOODLAND ESTATES

KALIHI VALLEY, OAHU, HAWAII

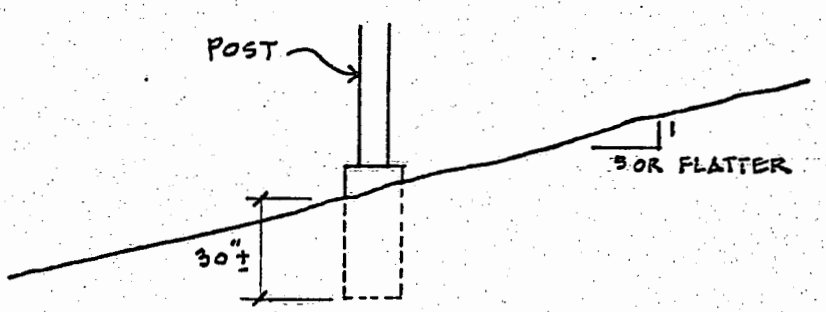
TMK: 1-4-14: 1 & 26

1-4-16: 3

WALTER LUM ASSOCIATES, INC.

CIVIL, STRUCTURAL, SOILS ENGINEERS

DECEMBER, 1973



SUGGESTED FOOTING - SILTY SOILS GENTLE SLOPE

NOT TO SCALE

FIGURE 2

SCHEMATIC FOOTING SKETCH

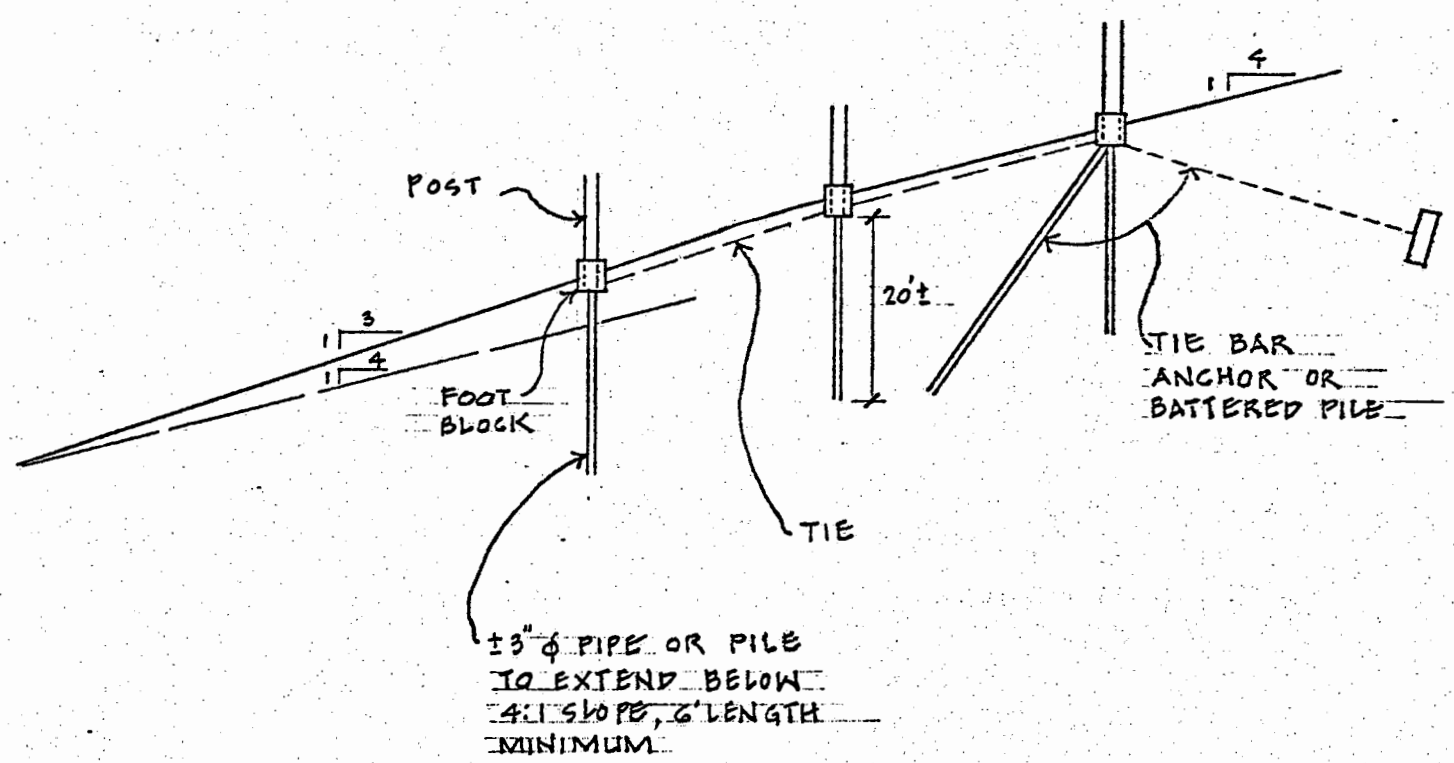
WOODLAND ESTATES

KALIHI VALLEY, OAHU, HAWAII

TMK: 1-4-14 : 1 & 26
1-4-16 : 3

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DECEMBER, 1973



NOT TO SCALE

FIGURE 3
SCHEMATIC DESIGN FOR
FOOTINGS ON SLOPING GROUND
WOODLAND ESTATES
KALIHI VALLEY, OAHU, HAWAII
TMK: 1-4-14: 1 & 26
1-4-16: 3

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DECEMBER, 1973

B-13

B-7

B-6

Note: Area under construction

Grading

Story Wood House

Stream

APPROXIMATE BOUNDARY OF SITE

NORTH

SCALE: 1" = 80'

LEGEND

- BORING FOR THIS REPORT
- BORING FOR KALIHI SUBDIVISION HORITA DATED JULY 18 1972
- FILL
- CUT
- ACTIVE SPRING DRAINAGE PATH
- INTERMITTENT DRAINAGE PATH
- APPROXIMATE LOCATION OF ACTIVE SPRING
- POSSIBLE SOFT & SLUMPING GROUND

NOTE:

CUT AND FILLS ESTIMATED FROM PRELIMINARY GRADING PLAN BY PARK ENGR. INC. DATED 9-28-73

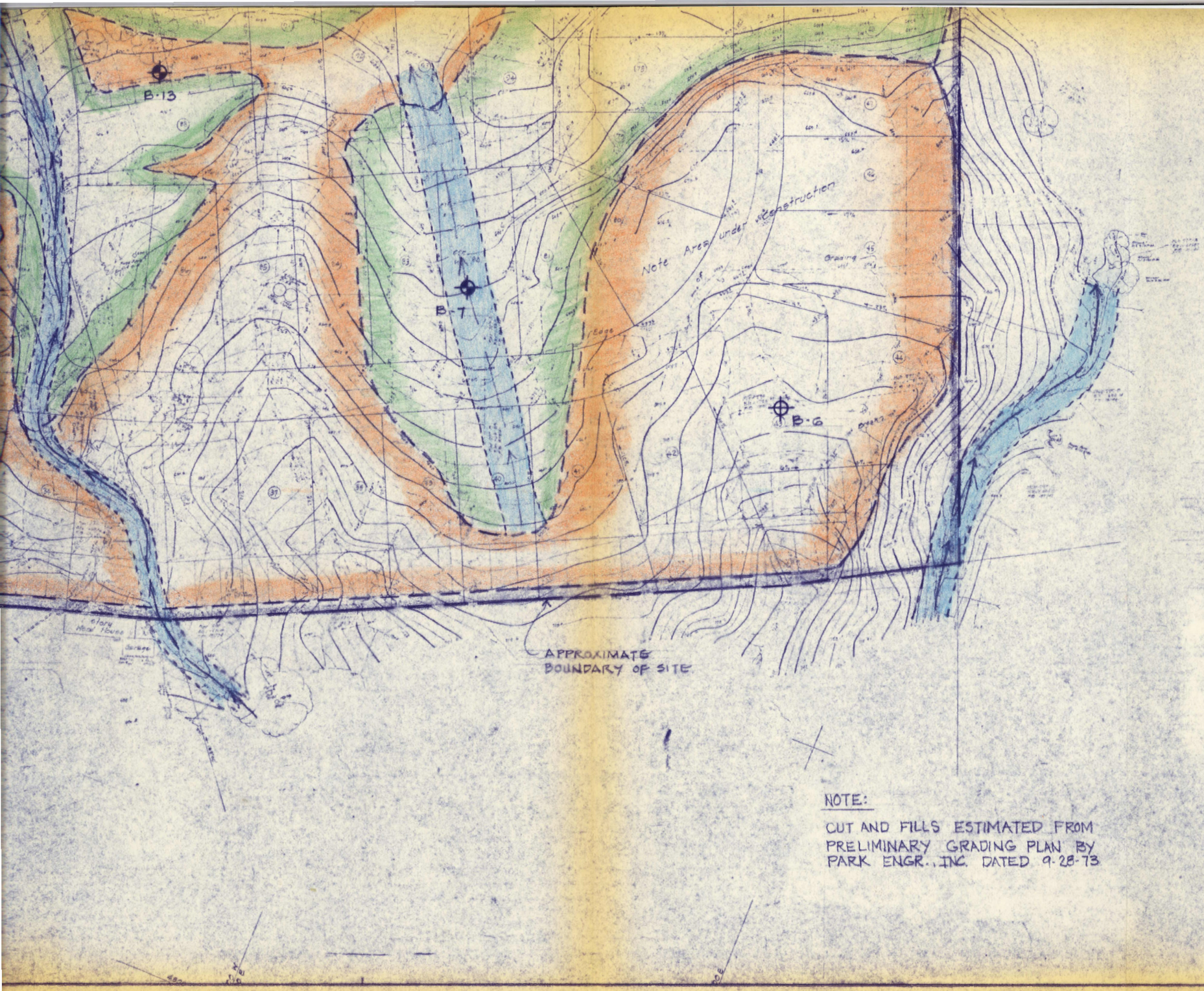
FIG 4

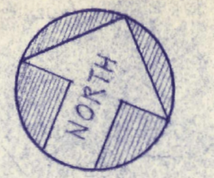
BORING LOCATION SKETCH
WOODLAND ESTATES
KALIHI VALLEY, OAHU, HAWAII
TAX MAP KEY: 1-4-14:1926, 1-4-16:3

Dr. ____
Date 11/73
Rev. ____

WALTER LUM ASSOCIATES, INC.
3030 WAIALAE AVE.
CIVIL ENGINEERS
PHONE 737-7931

Sheet ____ of ____





SCALE: 1" = 80'

LEGEND

- BORING FOR THIS REPORT
- BORING FOR "KALIHI SUBDIVISION - HORITA" DATED JULY 18, 1972
- FILL
- CUT
- ACTIVE SPRING DRAINAGE PATH
- INTERMITTENT DRAINAGE PATH
- APPROXIMATE LOCATION OF ACTIVE SPRING
- POSSIBLE SOFT & SLUMPING GROUND

NOTE:

CUT AND FILLS ESTIMATED FROM PRELIMINARY GRADING PLAN BY PARK ENGR., INC. DATED 9-28-73

FIG. 4

BORING LOCATION SKETCH
WOODLAND ESTATES
KALIHI VALLEY, OAHU, HAWAII
TAX MAP KEY: 1-4-14:1 & 26, 1-4-16:3

Dr.	WALTER LUM ASSOCIATES, INC.	Sheet
Date 11/73	3030 WAIALAE AVE.	
Rev.	CIVIL ENGINEERS	of
	PHONE 737-7931	

B-4

SOURCE AREA

B-10

SPRING "A"

B-11

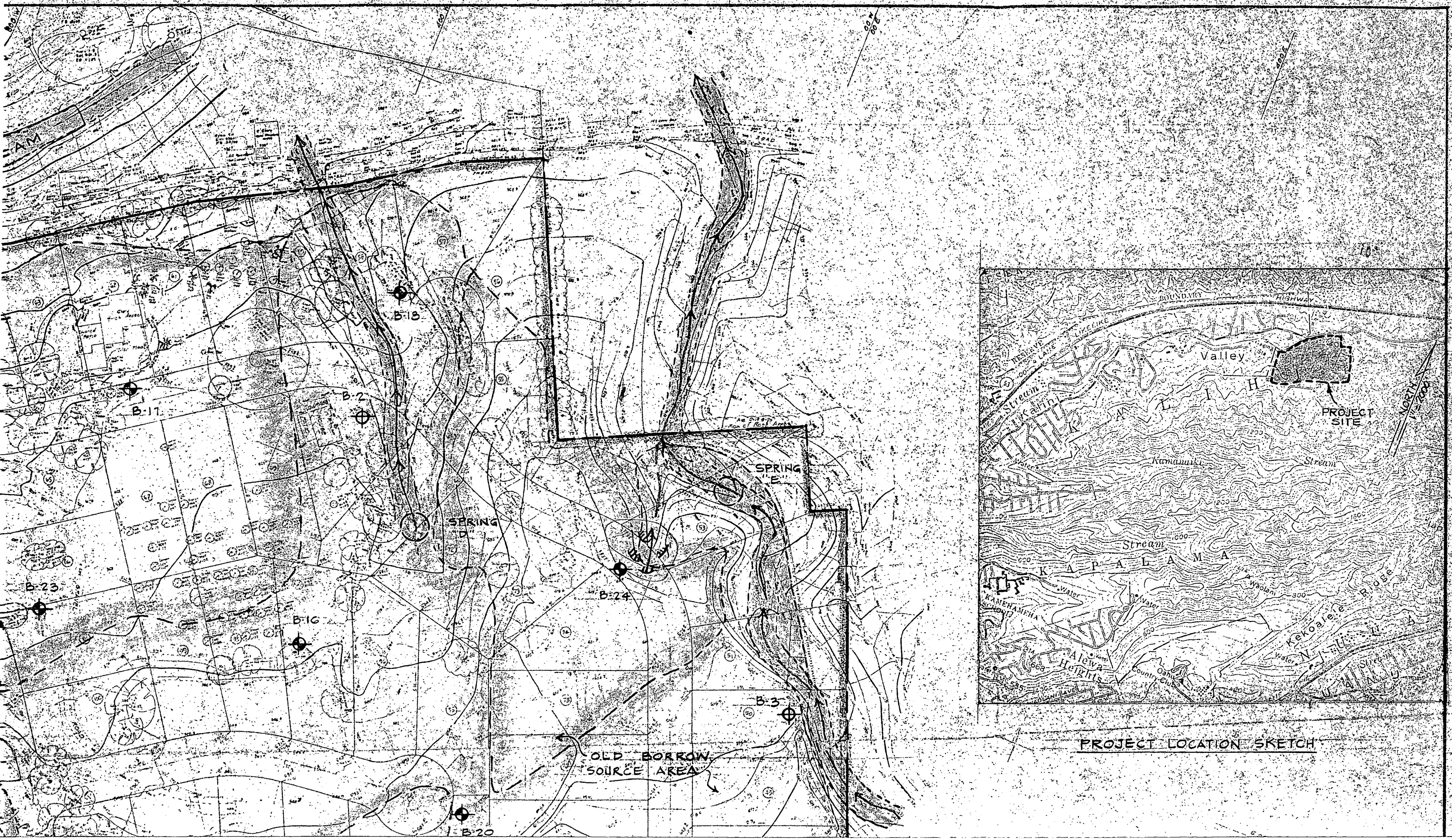
B-12

B-5

B-9

B-8

EXISTING NURSERY


B-18
B-2
B-17
B-23
B-16
B-24
B-3
B-20
SPRING D
SPRING E
OLD BORROW SOURCE AREA
Valley
PROJECT SITE
NORTH
Stream
KAPALAMA
Kekoalele Ridge
Alewa Heights
Oahu Country Club
KAMEHAMEHA
PROJECT LOCATION SKETCH

B-17

B-18

B-2

SPRING "D"

SPRING "E"

B-24

B-23

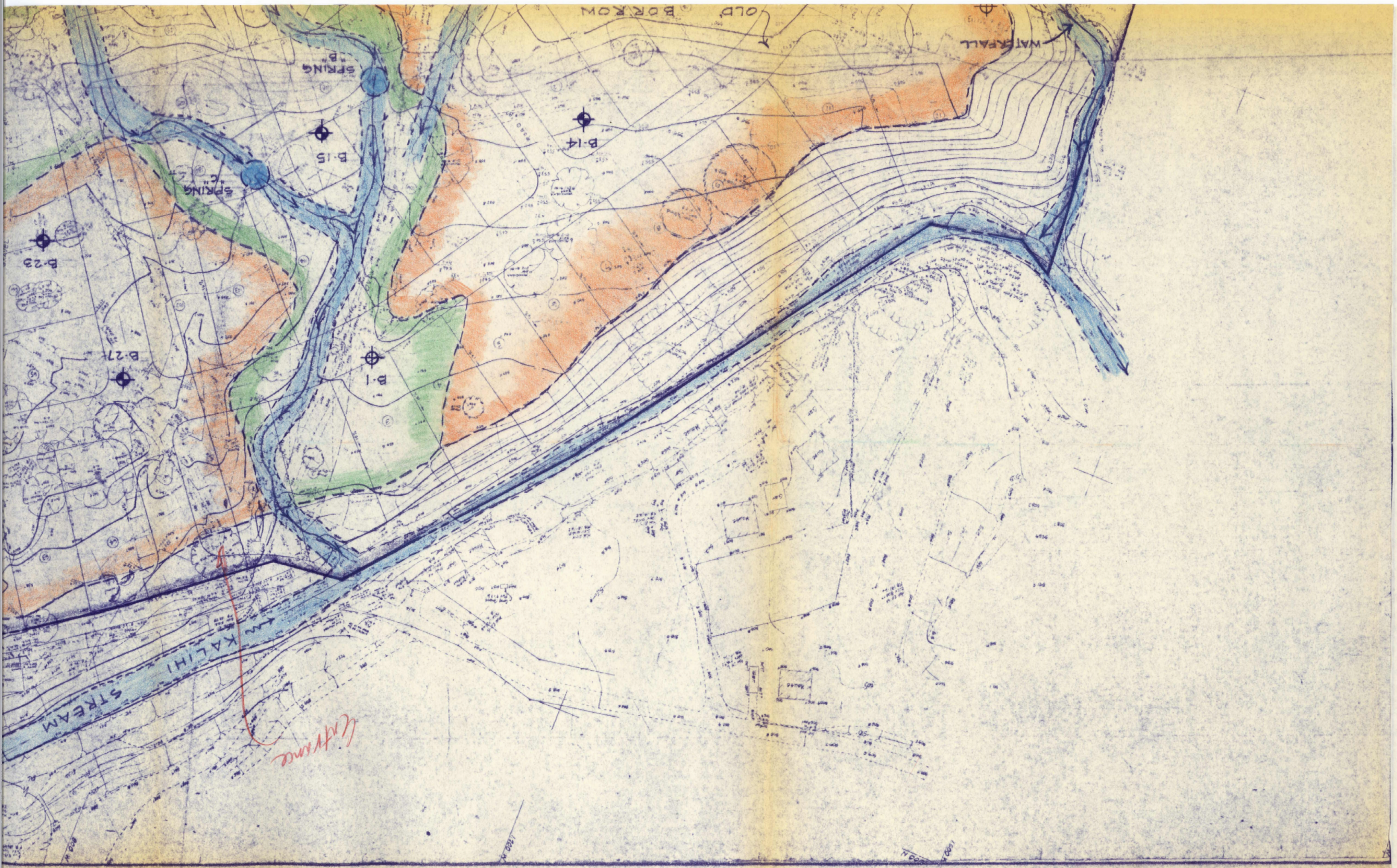
B-16

B-3

B-20

OLD BORROW SOURCE AREA

PROJECT LOCATION SKETCH


OLD BORROW
WATERFALL
SPRING B
SPRING C
B-14
B-15
B-23
B-27
B-1
KALIHI STREAM

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse, changed conditions, and changes in the state of the art of soil engineering.

Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.